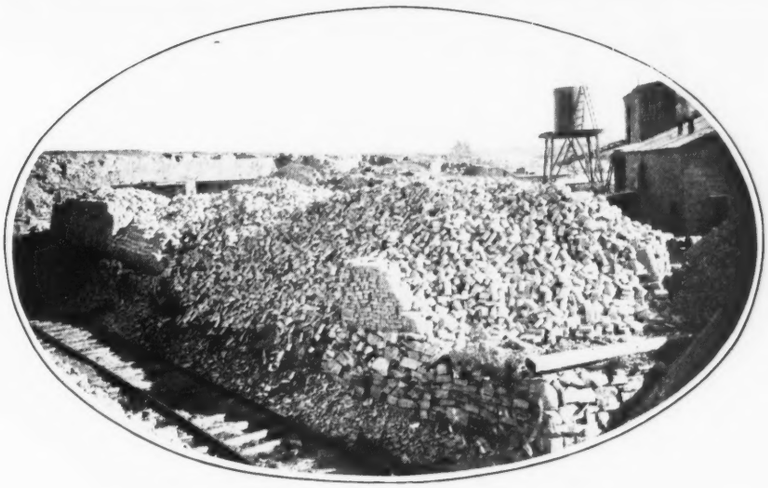
ENCE LIBRARY

DEC 17 1924

McGraw-Hill Company, Inc. December 13, 1924 Twenty-five Cents Per Copy

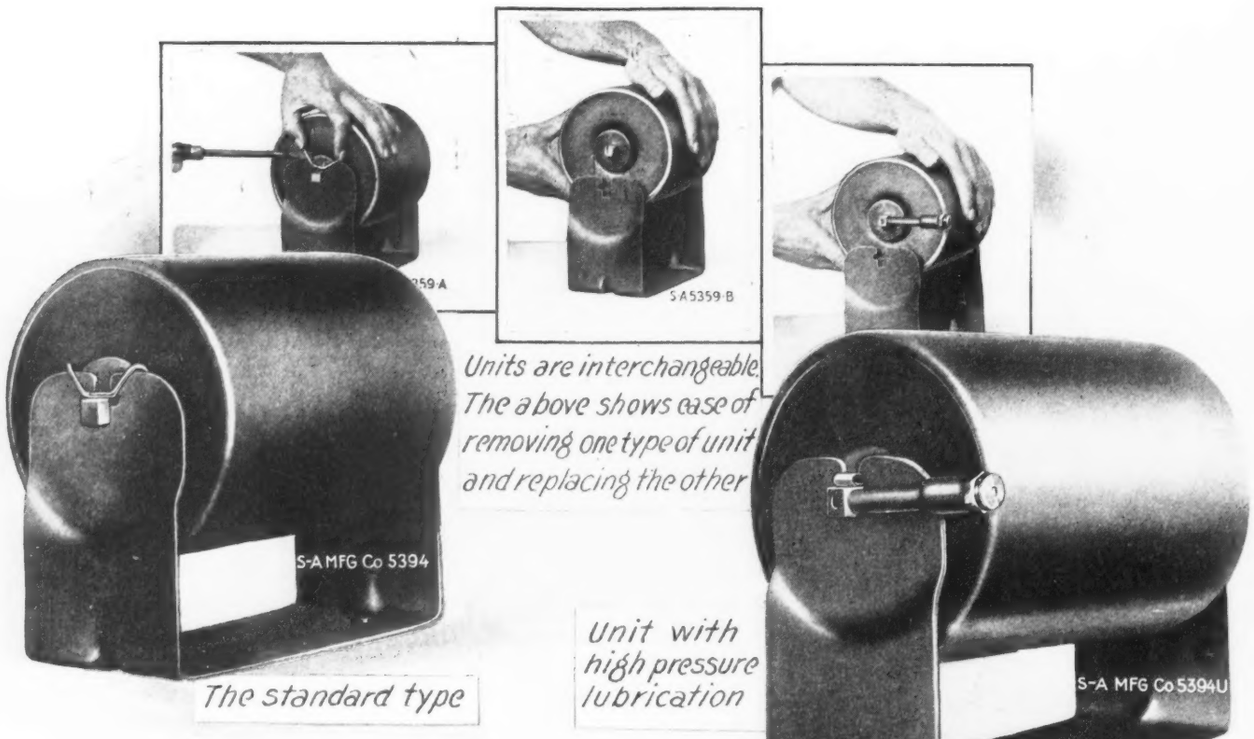
ENGINEERING AND MINING JOURNAL-PRESS

A CONSOLIDATION OF ENGINEERING AND MINING JOURNAL AND MINING AND SCIENTIFIC PRESS



Domestic Tube Mill Grinding Media, by W. M. Weigel—Arsenical Ore Deposits in the United States, by Robert H. Sayre—Cripple Creek: Inside Story of Early Days of This Famous Camp, by N. E. Guyot

From the Cape to Johannesburg—*Photographs*


S-A MFG Co 5394
S A 5359-B
Units are interchangeable. The above shows ease of removing one type of unit and replacing the other
S-A MFG Co 5394U
The standard type
Unit with high pressure lubrication

Two types of conveyor efficiency

Here are two types of S-A Unit Carriers—both the leaders in their respective types. These include the S-A Unit standard type Carrier and the S-A Unit Carrier with fittings for high pressure lubrication.

The S-A Unit Carrier in the standard type needs no introduction to mining men,—it is in use in all mining fields. The high pressure lubricated type is a recent addition to the S-A line. It has all the superior features of S-A construction with the high pressure lubrication feature added.

Both types are all-steel units built of heavy tubing with pressed recessed ends. Both are ball-bearing rolls, providing a smooth easy-turning roll, with minimum friction resistance and wear on the belt.

S-A Engineers are at all times ready to co-operate in the solution of your ore-handling problems. Their counsel implies no obligation.

STEPHENS-ADAMSON MFG. CO.
Aurora, Illinois

Stephens-Adamson

ENGINEERING AND
MINING JOURNAL-PRESS

JOSIAH EDWARD SPURR, Editor

Volume 118 | New York, December 13, 1924 | *Number* 24

Better Understanding Between Smelter and Miner

THE IDEAL SMELTER CONTRACT would be one in which the interests of both the buyer and seller were identical. Of course, the matter of negotiating the rates that are to apply is one in which interests cannot coincide; but a good contract will make it beneficial for both miner and smelter that the price of metals should be high, and that the miner should prepare his ore or concentrate so as to provide a product that will permit of the most economical smelting.

Two theories of drawing contracts are: (1) Paying for the full metal content, but making a flat per-ton treatment charge, in money, high enough to cover the cost of smelting the ore and provide the smelter with his profit; and (2) exacting no money charge, but deducting from the actual metal content a sufficient amount or proportion to cover treatment costs and profit. The smelter's pay comes in metal, not in money. The essential difference is that in the first case the smelter, in effect, has no metal of his own to sell; in the second he has. The first plan has been generally in vogue in Europe, although in recent years a tendency to modify contracts has been manifest. Contracts based exclusively on the second plan have been advocated by some smelting men in the United States, but have not, so far as we know, been adopted. The American practice is based on a combination of the two theories. The smelter takes part of his pay in each of the ways mentioned.

The trouble with the first or European plan is that the ore buyer necessarily tends to "bear" the metal market. His interest is to have the price of metals as low as it can be without reducing his intake of ore and concentrate. He has less capital tied up as metal in process if prices are low; and the metal being cheaper the demand is better, so that his marketing problem is less difficult. Moreover, a rising market normally is gradual, and a decline is rapid, so that the smelter for this reason prefers a bear market.

On the other hand, when the buyer of the ore takes a large proportion of his pay in metal, as he does in the United States, he becomes virtually a producer, and he naturally benefits by a high price, provided, of course, it does not go so high as to reduce consuming demand and therefore spoil his market. In this, obviously, his interest exactly parallels that of the miner.

Time was when the miner thought that the so-called treatment charge, plus penalties such as for zinc and excess silica, was sufficient to cover the cost of smelting operations; and that the various deductions from the metal content formed the smelter's profit. As a matter of fact the treatment charge was generally less than the actual cost of smelting the ore; the amount was made up in the deductions, which also provided for metal losses, cost of marketing and refining and the profit. The miner thought he was being robbed. Frequently he was, in a sense; but even if his contract was a fair one, he thought he was getting the short end. Recently some of the smelting companies have renamed the "treatment" charge, calling it a "base" charge or a "money" charge. The reason that the base charge is not discarded entirely is because the smelter would then depend solely on the sale of his "toll" metal for his pay; and, to protect himself from a very low market, he would necessarily make the deductions higher than otherwise. The miner would, in effect, insure the smelter against periods of dull market.

One of the troubles with the old contracts was that the miner frequently could not understand them. Now the smelter is inclined to lay his cards on the table. One new form of contract says: "Price: The purchase price of the product is the sum of the payments less the sum of the deductions next below specified." Then the various items are listed clearly and understandably. The base charge varies on a sliding scale, depending on fluctuations in the market price for lead and copper above or below 7c. and 14c. respectively. If, during the life of the contract metal prices decline, the smelter's pay decreases, and, on the other hand, increased metal prices give him additional revenue. This is not a new plan, but it is a fair one.

Another item under deductions is "Labor differential." By it the seller, who is the miner, agrees to a specific increase in the base charge when and if the prevailing wage scale is increased; on the other hand, he enjoys the advantage of any cut in wages. Naturally, the smelter can make his margin less when he does not have to insure himself against wage increases. Another customary provision that was not made ten years ago is to charge or credit to the account of the buyer differences due to fluctuations in freight rates on blister copper and pig lead. If the smelter agreed to bear these he would have to make the charge higher, to protect himself. He would manipulate those potent little figures that used to conceal his proceeds behind the mask of a low "treatment" charge.

The ore buyer of today is not a philanthropist, but he is trying to draw a contract that makes the interests of both parties the same. Moreover, he realizes that his own prosperity is dependent upon that of the miner. He may drive a hard bargain, but at least he shows the miner how it is done. It is another manifestation of the growing tendency to base business relations on frankness, mutual confidence, and square dealing.

Painless Voting

WHAT MAY BE CALLED the painless voting system, so popular among cultivated men, and exemplified in the American Institute of Mining and Metallurgical Engineers and many other societies, has this year been adopted by the Mining and Metallurgical Society of America, which puts out a ballot containing only one nominee for president and vice-president. There must be a deep-lying psycho-

logical reason for the prevalence of this system among mining engineers and other men of taste and refinement. Some of the advantages are obvious—it does not increase the strain on the already overtaxed intellect of the engineer; all he has to do is to instruct his secretary to lick the envelope; which indeed is more of a sacrifice of his energy and time than could reasonably be expected. What an immense saving of money and time there will be when this system spreads to the masses and is adopted for Presidential elections! What a saving of suspense—of business unrest on the part of the whole population of the United States! Fancy. The waste that would be eliminated, we have had our secretary estimate, would amount to some $3,475,000 for every four-year period.

Thoughtless Economy

THE PROGRAM OF ECONOMY in the affairs of the Federal Government, which President Harding initiated, and which has been carried on by President Coolidge, was a wise and necessary one. It is a pity that states and municipalities do not all adopt the same plan of reducing debts rather than piling them up, as is being done to a dangerous degree in some instances. Nevertheless, as even an ill wind blows somebody some good, the good winds also are sure to blow somebody some ill. What we mean was referred to by Secretary Hoover in a recent speech in Washington. While most of the expenditures of the government will bear paring, it is not good business further to shrink the little proportion which goes to the technical bureaus of the government—some 2 per cent of the total. Yet this is what is being done. Even this would not be so bad if it were done intelligently, by men who understood the comparative values of the different kinds of work done in these bureaus; but it is not. The Director of the budget—quite properly, as a principle—has full authority over expenditures in different departments of each bureau; and the general plan of economy of the Budget is to shave down each activity, without killing off any. Each cow (or mule) will have its rations diminished, but must survive. The trouble is that in many instances the departments in question have their allotments shrunk till there is only cash enough for the overhead—the organization is maintained, but there are no means left to get results to justify the organization. Sternly grappling with directors and secretaries whom the Budget instinctively knows to be plotting ruthlessly to circumvent the economy program, the Budget trusts them not nor listens to their already suspected and pre-discredited specious representations. The directors and the secretaries know the relative values of the different types of work. Often, they inform the Budget, it would be better to cut off some branches of activity completely, in order that what is left may be sufficiently watered by appropriations to be productive and bring forth fruit. This representation is looked upon by the Budget as plotting, and they suspect—nay, more than suspect—a desire to discredit the Budget economies and prejudice their efforts in the eyes of a temperamental Congress. So the Budget snaps the whip, applies the usual language to the mules, and the caravan goes on.

This is really working hardship on the technical bureaus. Directors and workers of these bureaus in Washington have found their positions less desirable in many ways, progressively during the last ten or twenty years. Technology and science are tender plants, which do not thrive on north winds. The government is losing by these nonchalant methods of too autocratic attempts at organization and public service and applause. Economy is a good dog, but Common Sense and Results are better ones. Economy, standing alone, never got any individual or government further. We hope Secretary Hoover, and Acting Secretary Gore, under whose jurisdiction some of these bureaus live, will find a way to make the respected and admirable Budget listen to reason. As to Secretary Work, under whose control similar burdens lie, he is hopeless.

Ketchup Bottle Caps and "Honest Miners"

ONE OF OUR ESTEEMED NEW YORK PAPERS stated recently that "A bluff, hearty miner from the great open spaces, with a heart like a refrigerator and a brief case almost as large, dropped in at John Sitkowski's café in Mineola yesterday and set everybody up to sarsaparilla, after which he showed them the gold nuggets which he had stuffed in his case. He was in a hurry to turn the stuff into cash, he said, and would sell the whole collection of nuggets for $2,000. A quiet stranger, who sat in a corner, offered to chip in $200 toward the purchase and another made a similar offer. Sitkowski, fearful of being left out, hastily contributed the remaining $1,600 and did not discover until after his guests had departed that the nuggets were merely ketchup bottle caps hammered into lumps. A little later Mrs. Margaret Dwyer, whose husband, John, a retired policeman, runs a hotel in Mineola, gave up $2,400 under similar circumstances. State troopers are hunting for the swindler."

This is a good story. Naturally we are sorry for Sitkowski and Mrs. Dwyer. However, we hasten to remark that there are actually a number of honest miners and mining men in the industry. Various scamps have masqueraded about under the appellation of "honest miner" since the days of '49, but most of them have never hardened their hands on the hind end of an ore car nor have they ever felt the thrill that accompanies the discovery of real gold. They are the thieves, scoundrels, and rascals, social dirt, as it were, this is an inevitable minor accompaniment of our civilization.

The use of hammered ketchup bottle caps is an innovation. We would expect that the proprietor of a café would recognize a ketchup bottle cap under any circumstances, but apparently cupidity blinds its victims quite thoroughly. We warn café dealers and others that the bona fide honest miner who has $2,000 worth of gold nuggets in his jeans knows how to convert them into money without calling upon Tom, Dick, and Harry to help him.

Exploiting Low-grade Ore

TOWARD THE END OF THE YEAR one is inclined to make a mental revision of progress, the contemplation of which usually prompts reminiscence of some significant step in former years, upon which present success is largely based. We wonder whether adequate attention has been paid to the tremendous significance attached to the exploitation of low-grade ores, as a specific goal toward which several prominent engineers have strived. Some have attained success, others are forging ahead toward an ideal of

cheap and efficient operation that seems almost in sight. Work of this character requires unusual initiative, foresight, perseverance, moral support, and capital. History shows that the moral support is seldom given; it is so much easier to deride the efforts and belittle the ambitions of those whose professional actions indicate a disregard of the safe and easy road to mediocrity; it is so much easier to pose as a prophet of disaster, knowing full well that if success is won by effort and determination, the adverse comments of the doubting Thomases will soon be forgotten.

The pioneer in any new development has a hard row to hoe. This has been particularly true in regard to the successful exploitation of low-grade ore. Few among the rank and file of professional men, comprising the majority content to follow the trail blazed by others, realize the mental strain involved in overcoming obstacles, fighting opposition, and forgetting failure in an effort to do what it is believed can be done in the direction of economic as well as technical success. In the field of low-grade ore treatment we call to mind several exemplars of initiative and perseverance, each of whom deserves the recognition, moral support, and encouragement of the profession.

Eliminating Nerve Waste in Industry

A THING does not have to be ugly to be practical. A man does not have to be gross to be strong minded. An advertisement does not have to clash and outrage in order to be good business. Many advertisers evidently think the contrary; but the day of "raw" advertising display is passing in favor of the artistic and ingratiating method, which pleases at the same time that it suggests. Many advertisements of the old crass school inspire the sensitive beholder with aversion, and he would instinctively go a long way to avoid buying the article advertised.

As the opposite extreme—as illustrating the complete subordination of the bumptious to the artistic—the palm might be awarded to a catalog which we have recently received from Italy. The carrying cover of pasteboard enchained our attention—a flaming impressionistic design which we did not understand but which made us curious to go on. Once opened, we went through the little volume in minute detail, because it was a pleasure and not because we were hungry for information concerning V & D firebrick, which it is designed to sell. The V & D firebrick—we name it from memory, you see—ingratiated itself pleasingly into our consciousness and memory; and yet the catalog said mighty little about it. Each page is a beautiful picture—a work of art. From the *Ex Libris* at the front, followed by the neatly printed red-lettered inscription *"Esemplare per Engineering and Mining Journal"* ("copy for the *Engineering and Mining Journal*") to the final leaf, which represents a firebrick supported on a gush of red flame, everything pleases the eye and impresses the imagination. The story of the firebrick is told by a series of delicately colored pictures, one on a page, with a slight hand-written script of explanation under each, forming a running but simple story; in fact, a single long sentence runs through the whole little volume.

No, dear reader, this is not an ad—nor a puff. We do not advertise V & D firebrick, to the best of our editorial knowledge and belief; but we present our compliments to Giuseppe Verzocchi, manager of the Milan agency which sells the bricks; and express our belief that Italy is again leading.

We have been moved, along much the same lines, to write to the Editor of *The Explosives Engineer;* and to economize writing, we publish the letter instead of paraphrasing it.

"In looking over the copy of *The Explosives Engineer* which lies on our desk this morning, it occurs to us to express our appreciation of the artistic cover, of the fine drawing with the biography of Mr. Charles Warner, of the reproductions of paintings belonging to the Beckett collection, and of the editorial on page 378. As you say in the editorial, the picturesqueness of mining has few interpreters. It is also strangely true that mining has little literature in the true sense, contrasting strongly with seafaring, for example. Some day we hope this may be remedied and the picturesqueness of this most romantic calling may be chronicled."

The Explosives Engineer is a "house organ," published by the Hercules Powder Co. No, dear reader, this is not an ad—nor a puff; although the Hercules people, we believe and hope, do advertise with us; but *The Explosives Engineer* makes us inhale powder fumes with an agreeable and a comfortable feeling—not with the headache we are fain to associate with the fumes, in our mining memory. Anyone who can charm us and sooth us with a tale of firebrick or explosives is welcome. Agreeableness is an effective selling principle. Why not do the work of life gracefully and harmoniously, instead of by jerks and with a crash of crockery? We often think of the diplomat who was so accomplished that

> "He kicked you down stairs with such a sweet grace
> That you thought he was handing you up."

And we recall that someone recently said of two mine managers that it was pleasanter to have your request refused by the one than to have it granted by the other. Is not this a sheer case of waste in industry?

Mine Examination With the Microscope

THE *New York Sun* in a recent issue reports the following concerning the Engineer Mine, which is situated in British Columbia:

"Officials of the mines report that Profs. Charles P. Berkey and R. J. Colony, consulting geologists of the Columbia University School of Mines, who have completed their analytical report of ores from Engineer Gold Mine, find that the vein system originated and was deposited under igneous control, *indicating the continuation of veins and the maintenance of bonanza values to great depth.*"

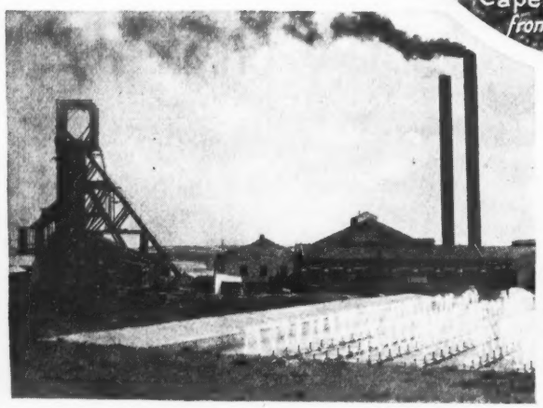
Regarding the clause italicized we do not believe that Professors Berkey and Colony ever made such an unwarranted and probably incorrect deduction from the premises stated. In general, however, geologists should be cautious in reporting on samples of ore sent from mines which they have not examined, since many mine promoters find this the cheapest and quickest way to secure the leverage of well-known and honorable names to assist them in their financial boosting.

Long experience would indicate that ordinarily a geologist should not report on a mine without having seen it: moreover, the conservative geologist will not report on a mine without having examined it thoroughly. The commercial side of a mine cannot be judged with a microscope; to imagine that this can be done is to add another item to the list of abuses for which the excessive addiction to the microscope is responsible—a subject which we have already editorially twice discussed.

From the ~ CAPE *to* JOHANNESBURG

Above ~ Gold mining on the Eastern Witwatersrand, Transvaal. Plant of Springs Mines, Ltd.

Above ~ Gold mining on the Witwatersrand, Johannesburg. Looking west from the dump of Ferreira Deep, Ltd.



Above ~ Diamond mining at Kimberley Dutoitspan shaft and steam plant of De Beers Consolidated Mines, Ltd

Above ~ Another gold mine on the Eastern Witwatersrand. New headframe and steam plant of West Springs, Ltd., organized in 1918 to acquire a Government lease.

Left ~ Cyanide plant of West Springs, Ltd., under construction

© *Photographs by courtesy of A. W. Newberry*

Domestic Tube-mill Lining Successfully Meets Foreign Competition*

By W. M. Weigel
Mineral technologist, U. S. Bureau of Mines

W. M. Weigel

PREVIOUS to the World War, the entire supply of flint or siliceous blocks for tube-mill lining was imported from Europe—mostly from Belgium. High freight rates and uncertain shipping facilities created by conditions caused a search for American sources. Three developments resulted, one in Florida, one near Iron City, Tenn.,[1] and one at Jasper, Minn. The one at Jasper, the property of the Jasper Stone Co., is the only one now operating. The stone produced at Jasper is a highly indurated, pink quartzite, known as the Sioux quartzite, of Huronian age.[2] It was formerly quarried for paving blocks and building stone, but its use for paving was discontinued, because the surface of the cobbles became polished and smooth in service, rendering the footing insecure for horses. Stone unsuitable for mill linings and grinding cubes is still used locally for structural purposes, especially for door and window sills and lintels, and scrap and unsound stone is crushed to the various commercial sizes. A limited amount of stone for chaser mills grinding silica and feldspar is also produced. This stone is 6 ft. in diameter by 16 to 18 in. face.

The general quarry conditions and method of operation are shown in Fig. 1. From one to four feet of stripping is necessary. The face at the highest point is about 35 ft. high. The best rock for liners is in the lower part of the face, extending into the floor. The company states that it has drilled to a depth of 125 ft. without passing beyond stone suitable for liners. The upper 10 ft. is more or less fractured and jointed at different angles, and is sent to the crushing plant. The bedding is approximately level, and the vertical joint planes are nearly at right angles to one another, which greatly facilitates quarrying operations.

Drill holes are put down 15 to 20 ft. back from the face to the floor level, with a 6-in. blast-hole driller. These holes are loaded with just enough slow, black powder to loosen the rock along the beds and joints without throwing it from the face. The loosened blocks are then worked up with plugs and feathers in holes 6 to 8 in. deep.

Most of the stone splits in almost perfect planes in both directions, at right angles to the bedding, and those parts which will not so split are not suitable for liners. After splitting, the blocks are lifted out with a 30-ton locomotive crane, loaded on a car, and delivered to the finishing yard. Air hammer drills are used for all holes, except for some work in progress for leveling the quarry floor.

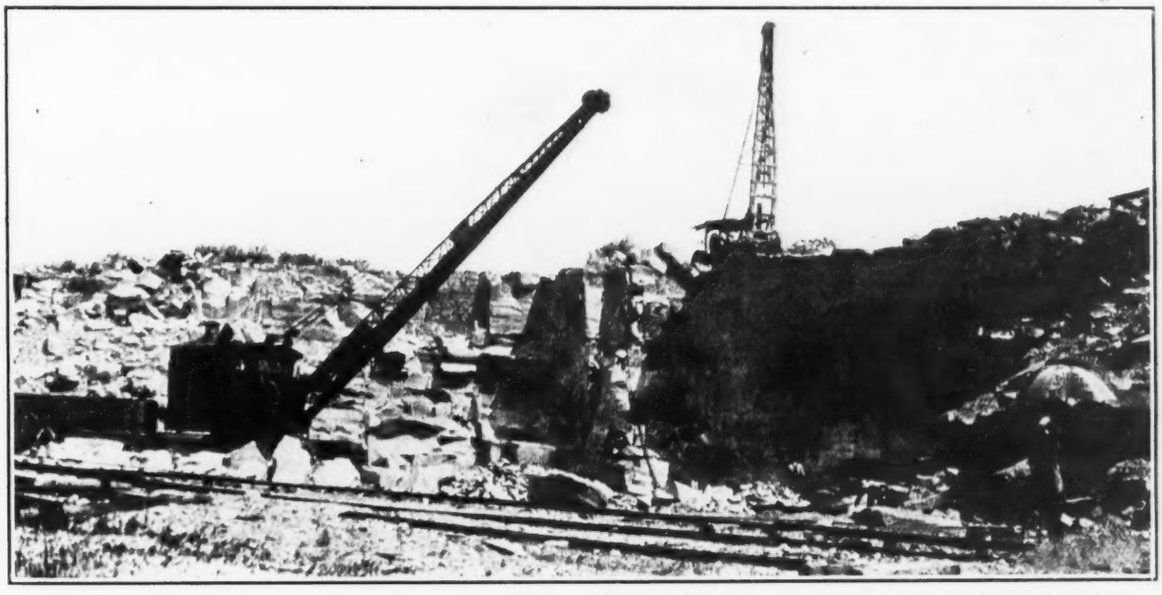


Fig. 1—Quarry of the Jasper Stone Co., Jasper, Minn. The face has a maximum height of 35 ft.

In the yard, the quarry blocks are again split with plugs and feathers into slabs as near one of the smaller dimensions of the lining blocks as possible. The wearing face of the finished block is always made parallel to the bedding plane. The thin slabs are worked up by

*Published by permission of the Director, U. S. Bureau of Mines.

[1] "Mineral Resources of Waynesboro Quadrangle," State Geological Survey of Tennessee, Bull. 26, p. 132.

[2] "Structural and Ornamental Stones of Minnesota." Oliver Bowles, U. S. Geological Survey Bull., 663, p. 204.

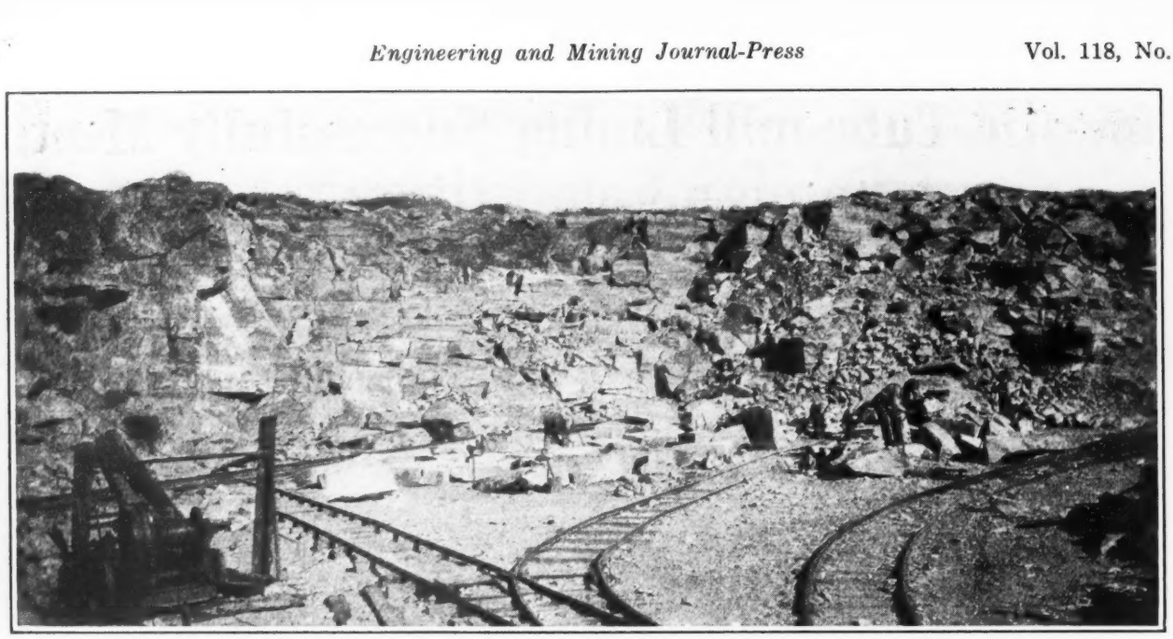


Fig. 2—This shows that corner of the quarry from which the "Adamant Silica Stone" for lining blocks and grinding cubes is obtained

square-faced hand hammers and trimmed to the dimensions desired. No chisels or points are used, except a stone "set," in marking around the slab before breaking off each block. All trimming of the blocks is done with the corner of a square-faced hammer, the face of which is slightly concave parallel to the eye or handle. While being trimmed, the block rests on a bed of sand contained in a half barrel, raised to a suitable height. The splitting of the large blocks and hand trimming of the liners are shown on the cover of this issue. Fig. 4 is a halftone illustration of a part of the stock-pile. The final finishing of the liners is done by experienced stone cutters, who are paid by the piece.

All standard liners are cut 5 in. wide and with a length of 8 to 12 in., depending on specifications. The thickness is 3, 4, or 5 in., to meet requirements. The mining companies and cement plants generally use the 5-in. liners; grinders of silica and feldspar usually specify the 3-in. The allowable limit of variation from a plane surface on the edges of the blocks is fixed at ¼ in., so that they make a close-fitting joint in the mill. Special shapes for end liners and conical surfaces are more difficult to make. There are no standards for these, as the different mill operators have special requirements as to arrangement. Standardization in making specifications of liners would materially reduce production costs.

In addition to the lining blocks, grinding "pebbles" are produced to take the place of flint beach pebbles. They are approximately cubes, and range in size from 2½x2½x2½ in. to 6x6x6 in. Some of the scrap and the imperfect liners can be worked up into these forms. They are all hand made, like the liners, but do not demand the same degree of skill, as a cube spoiled for 5-in. size can be cut down to 4 in., and the allowable variation in size is greater. The slabs of stone are split and re-split, until of the proper dimensions two ways, and the face is then finished with a hand hammer. During the war, special machines were designed and built to make these cubes, but though mechanically successful, it was found that the cost of splitting and preparing the strips of stone for the machine was such a large part of production expense that their use was abandoned.

The square-cornered, rough pebbles are used by concentrating and cement plants. A rounded pebble is also produced that is shipped to silica, feldspar, and glaze grinders, and to points where freight charges are high, as the saving in freight due to the lighter weight of the rounded pebbles compensates for their greater cost. They are made by placing a charge of cubes, all of the same size, in an 8x10-ft. batch-type pebble mill, and running at 24 r.p.m. for five to eight hours. This rounds off the corners and angles of the cubes, gives them a smooth surface, and causes a reduction in weight of about 23 per cent. As, when placed in service, these corners must be worn down before effective grinding is done, the advantage gained and the saving in freight are evident. This rounding is done both wet and dry. Wet grinding gives a smoother surface, but takes longer. The portland cement manufacturers also use considerable quantities of rough, irregular stones, screened out of the crushed-stone product, as grinding media.

The proportion of total rock quarried produced in the form of liners and pebbles was stated to vary from 20 to 35 per cent. The plant operates throughout the year, but in the winter more waste is made, as the frozen stone does not split so perfectly.

All scrap and unsound stone is loaded into two-ton cars and hauled up an incline to the crushing plant, Fig. 3. The initial crusher is a No. 8 Kennedy gyratory, which discharges to a bucket elevator and to a trommel. The oversize returns to a No. 6 Austin gyratory, the discharge of which joins that of the first crusher. The discharge chutes of the crushers are lined with quartzite blocks to take the wear. Revolving screens make the usual sizes of crushed stone for road building and concrete. The minus ⅜ in. goes to a Hummer screen, with two screening surfaces, 8 and 40 mesh. The minus ⅜ in. plus 8 mesh product is sold as stucco finish. It is permanent in color and is non-absorbent. The minus 8 plus 40 mesh, called sand, is used largely in the surface coats of concrete floors. The minus 40 mesh is mostly a waste product, but might be suitable for use as an abrasive if freight rates to consuming centers were not prohibitive. The crushed-stone products are stored in bins over railroad sidings or stock-piles, outside, and recovered by locomotive crane.

The hard, tough character of the rock makes the wear on crusher parts, elevators, and screens excessive. Even

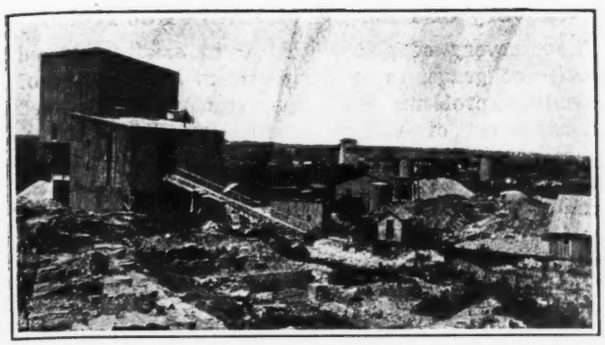


Fig. 3—Crushing plant where scrap and unsound stone is prepared for use in road building, concrete, and as a stucco finish

with manganese-steel wearing parts, renewals must be frequent.

A Fairbanks-Morse, 200-hp., 4-cylinder fuel-oil engine, directly connected to a 3-phase, 440-volt, a.-c. generator, supplies all power for the plant, including the air compressor for the rock drills, which is motor driven. This is housed in a separate building, shown to the right of the crushing plant.

The rock is a rather fine-grained quartzite, in which secondary enlargement of the original quartz grains or cementation by the deposition of silica has taken place. Little iron oxide or other cementing material is present, as is shown by the photomicrograph of a thin section between crossed nicols, Fig. 5-A. As Belgian flint, or silex, is the only other lining material commonly used, a comparison of the structure of the Jasper stone with the Belgian is pertinent. Fig. 5-B shows a section of Belgian silex lining between crossed nicols at the same magnification, 45 diameters. The difference in the texture of the two rocks is at once evident. Though the Jasper stone is a typical quartzite, the Belgian is just as evidently a flint or chalcedony, with some small phenocrysts of quartz and calcite, the latter being present in considerable amount. The structure would indicate that, though the Jasper stone would be more tough and have probably greater crushing strength, because of the interlocking grains, and be more uniform, its resistance to abrasion would be less, as it would wear away by individual quartz grains becoming detached from the surface. The Belgian stone would be more brittle and fail by chipping or fracturing, rather than abrasion, and is not acid resisting, owing to its calcite content. These conclusions seem to be borne out in practice. The chemical analysis of Jasper stone, as made at Iowa State College, and physical tests, are as follows:

	Per Cent
Silica, as quartz	94.00
Silicates of alumina and potash	2.40
Hydrous silicate of lime	2.00
Iron oxide	1.60
Crushing strength, lb. per square inch	45,300
Abrasion by standard rattler test	4.6
Toughness, French coefficient	21.5

Iron and alloy steel linings and balls have largely replaced flint linings and pebbles as grinding media in tube mills in the mining and cement industries, although, under certaain conditions, the stones are still used. In the grinding of silica, feldspar, whiting, and glazes for the ceramic industry, flint or porcelain liners are, however, necessary, as particles of metallic iron must be kept out of the product.

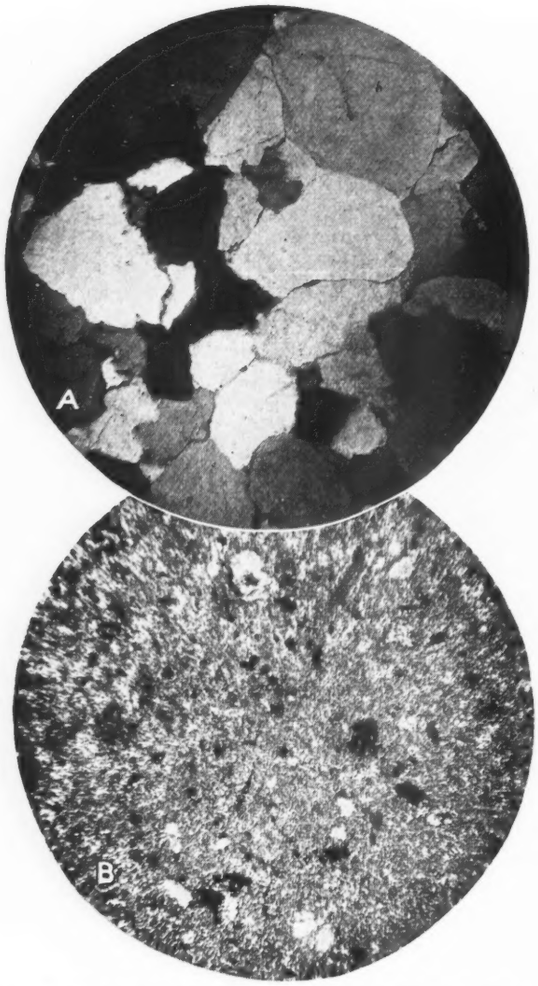
The Calumet & Hecla Consolidated Copper Co. uses both Jasper quartzite and Belgian silex linings in its Hardinge mills. It states[3] that the Jasper lining is cut more uniformly than the imported product, and the cost per ton is less. The life of the lining is about one-half that of the Belgian, but, owing to lower cost and better finish, the two materials are about on a par when calculated to cost per ton of material ground. The mills take a $\frac{3}{4}$-in. feed and grind through a limiting size of 28 mesh. The life of a Jasper lining is about 4,000 tons. It is further stated that the domestic lining is more uniform in quality, so that the lining will wear out uniformly, whereas with the Belgian, it often happens that a few blocks require renewal before the whole lining is worn out. This necessitates stopping the mill and thus losing time. The lining blocks that are used are 5 in. thick.

The Utah Copper Co.[4] formerly used both California pebbles and Jasper cubes for fine grinding. The consumption of pebbles averaged 3.158 lb. per ton ground, whereas that of the Jasper cubes was 2.032 lb. per ton. The cubes were replaced with cast-iron balls to increase grinding capacity. Jasper stone liners are used in the flotation cells. These were first tried out in 1919 to replace iron liners, and now all cells are lined with the quartzite. None have as yet required renewal, and it is estimated that their life will be several years longer, as they have good resistance to sand abrasion and acid corrosion.

The Pittsburgh works of the Standard Sanitary Manufacturing Co. use Jasper liners in Hardinge and batch-type tube mills, grinding an enamel glass used in the enameling of cast iron. The feed is from pea size to fines, and the material is ground to pass 60 mesh,

[3]Private communication.
[4]Private communication.

Fig. 4—A portion of the stockpile showing the rectangular liner blocks



Figs. 5a and 5b—Jasper stone is shown above and Belgian silex below. Magnification is 45 diameters, using crossed nicols

with a considerable amount finer than 200 mesh. The wear on the lining is slight. An alloy of two parts lead to one part tin is used to fill the joints between the blocks, instead of the usual cement. Rounded Jasper stone cubes are used as pebbles and considered superior to porcelain pebbles or balls.

A plant grinding silica sand with the feed through 20 mesh to a finished product of all through 150 mesh, for pottery manufacturers, uses Jasper liners in batch-type mills. These are 7 ft. in diameter by 8 ft. long and grind about ten tons per day. The liners, 3 in. thick, last one year, so a lining of this thickness grinds approximately 3,000 tons. French flint pebbles are used. Belgian liners were formerly used, and the company reports that, though the Belgian outlasts the domestic lining, the cost of grinding is about the same, and they prefer the domestic product. Some other silica grinders who have tried out the domestic linings report that they prefer the Belgian blocks on account of their better wearing qualities.

The Jasper Stone Co. is authority for the statement that about 80 per cent of its output of liners and cubes goes to the portland cement grinders, and that service of four years in 6-ft. tube mills lined with 4-in. blocks, using iron balls and nut punches in place of pebbles, has been reported. The minimum life for cement grinding is stated as two years.

Recovery of Placer Gold from Pot Holes

The recovery of placer gold from small scattered deposits of gravel in existing stream beds is one of the minor problems that has only rarely engaged the attention of mining engineers. Such deposits are usually too small to be dredged or to warrant fluming. If wing damming is out of the question, owing to bedrock conditions and the smallness of the deposit, no other method is available. The use of diving apparatus has been tried out, but has proved to be impracticable. Nevertheless, more or less attention has been given to the subject. A design has recently been worked out by Rudolf Peterson that involves novel features, but which has never been tried out.

The plan of the designer is to work only high-grade deposits. The device consists of a small barge upon which is placed derrick equipment for the operation of a grapple bucket for the removal of large stones and boulders and loosening up the ground under water. For handling the fine material and cleaning up the bedrock, the inventor proposes a form of bucket elevator that can be moved over a limited area. The elevator is placed in a well and is supported by wire ropes in such a way as to admit of raising and lowering. Gears and universal joints permit of driving the head pulley of the elevator as the elevator is moved about. The loosened gravel is excavated to bedrock and delivered by a swinging spout to sluice boxes. Attached to the elevator at its lower end is a frame carrying three sprockets, over which pass chains carrying stiff brushes, which are designed to sweep the bottom material up a sole plate that discharges into the buckets of the elevator. Only the broad features of the design have been suggested. Many details have not been worked out. Application for patent has been made.

An ingenious form of water telescope has also been devised. This consists of a hollow open-mouthed vessel attached to a telescopic pipe. A plate-glass diaphragm is provided, above which is a reflecting surface and electric lights for illumination. These are arranged so as to allow only the light reflected upward from the surface under examination to pass through the telescopic tube. A jet of water is provided for clearing the glass. It is expected that this water telescope will be useful in assisting operation of the bucket elevator.

The ingenious nature of the design and the fact that no mechanical devices have so far been invented that will successfully cope with the problem makes the proposed method worthy of record.

Story of Nevada Bonanza Still Holds Lure

Tradition has it that the Hardin emigrant train camped somewhere in the desert northwest of Winnemucca, Nev., during its trek to California in 1849; and that near the camping ground was discovered a veritable mountain of high-grade silver ore. Samples brought to California were said to contain native silver in obvious quantity. A return to the district by several members of the party, however, resulted in failure to rediscover the deposit. The tale of untouched wealth spread, and many joined in the search, only to meet with disappointment. The enthusiasm that prompted the quest then gradually subsided, but the legend has recently been revived, and an airplane search has been suggested as an effective means of prospecting the district.

Arsenical Ore Deposits in the United States

A Geological Survey of Some Western Prospects and Mines

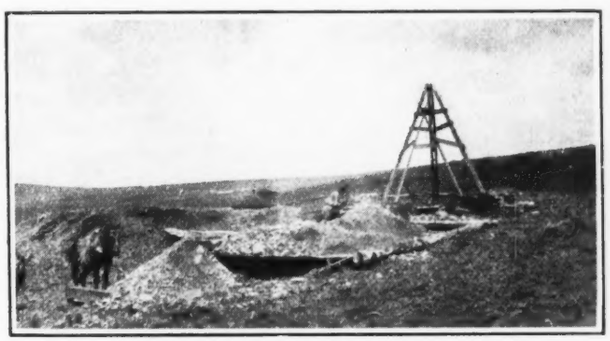
By Robert H. Sayre
Mining Engineer, Denver, Colo.

ARSENIC, a mineral Cinderella, has been rescued from her lowly position as an obscure byproduct, despised and rejected in the mines where she made her home, and whisked into the light where she suddenly appears as a belle fair enough to be courted for her own sake. The fairy godmother in this case is the small but voracious boll weevil, and so efficient has been her magic that arsenic recently became more precious than either of her base-metal sisters, lead or zinc, for a time.

As the supply of byproduct arsenic cannot be quickly increased to keep pace with the growing demand, and may never catch up with it again, an active search for arsenical ore deposits has been initiated. Arsenic, mined for itself, will, peculiarly enough, come from other minerals than those which supply most of the byproduct ore. The important Anaconda production, for instance, comes from the smelting of copper ores containing only 0.25 to 0.35 per cent arsenic, and this small percentage is in the form of enargite—copper sulpharsenate.

In arsenic mining, as such, the usual ores mined will be as follows:

Arsenopyrite, otherwise known as mispickel or arsenical iron, is iron sulpharsenide. When pure it



An arsenic prospect in Colorado

contains 46 per cent arsenic. This primary mineral is the most common and will probably be the most important source of arsenic. Its pyritic appearance but different crystallization and very similar mode of occurrence, combined with its silver-white color, make it easy to recognize in the field except where oxidation has tarnished the color. If cracking the specimen will not give a fresh surface, the arsenic reaction before the blowpipe is very distinctive. Another quick test is the characteristic "garlic" odor produced by striking the ore a smart blow with pick or hammer. Several large reported deposits of arsenopyrite have turned out to be pyrrhotite—magnetic iron pyrites. Occasionally the tarnished minerals are, in fact, hard to distinguish, but if one's outfit includes a small magnet the pyrrhotite is quickly identified.

Scorodite, hydrous ferric-arsenate, supposedly carries more than 50 per cent arsenic, but usually will be found to run not more than 30 per cent. It has an earthy,

Mountains near Elkhorn, Montana, where an unusual deposit of arsenical ore occurs

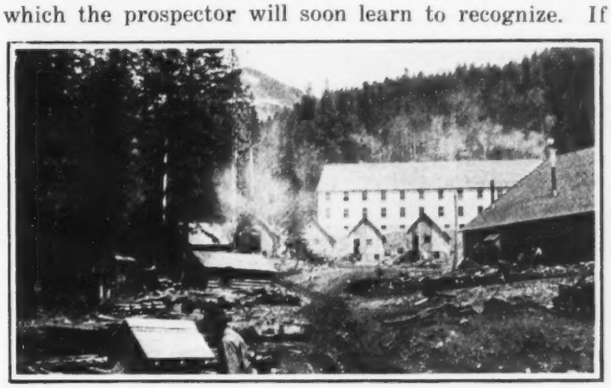
pale, olive-green color, and generally occurs amorphous, so that it is not easily recognizable at first. The mineral is secondary after arsenopyrite, and usually carries the latter in residual grains visible to the hand glass. This next most important ore is found near the surface in many deposits and to considerable depth in a few.

The brilliant red arsenic sulphide, realgar, and the somewhat rarer yellow sulphide, orpiment, have been mined unsuccessfully in Washington, but so far have not been found in quantities which warrant commercial exploitation as arsenic mines. Where their recovery is incident to major gold operations, as in Nevada, they have proved an important source of revenue.

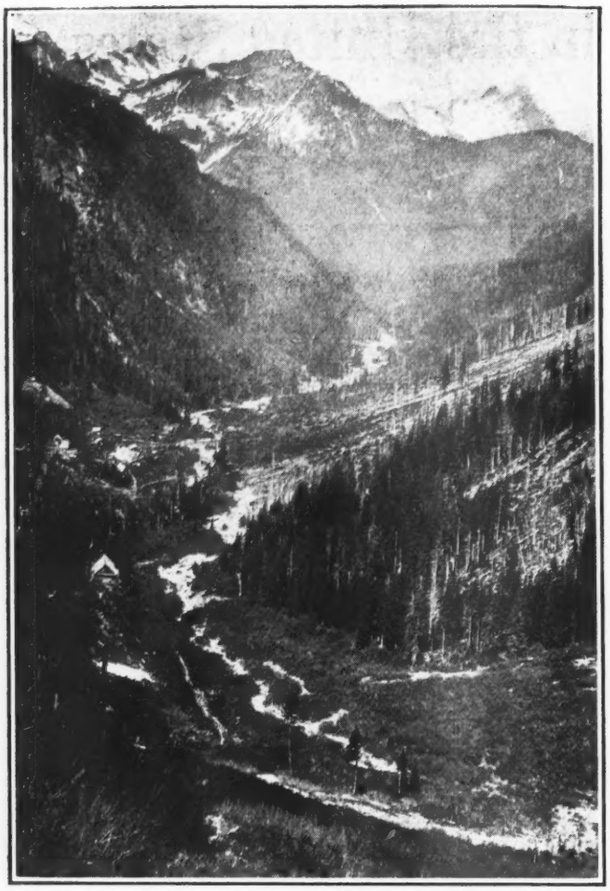
It is now customary to speak of the arsenic content of an ore in terms of the metal, As, and not in the percentage of the oxide, As_2O_3. The arsenic content is about three-quarters of the As_2O_3 content.

Arsenical ore deposits occur in a variety of forms and in rocks of nearly every age. The most widespread occurrence is as lenses along zones of shearing and contortion in schists and slates, although fissure veins and contact deposits are common. It is found in rocks of any age from the Pre-Cambrian schists as in Nova Scotia to the Tertiary granites of the Cascade Mountains in Washington.

Surface oxidation of arsenopyrite which has leached out the sulphur results in the dull-green scorodite, which the prospector will soon learn to recognize. If



Mascot mine above Hailey, Idaho



Monte Cristo, in the Cascade Mountains, Washington

the oxidation is carried still further, with the resulting loss of most of the arsenic, the outcrop will consist of reddish-brown gravel of a rich color different from the more yellowish and earthy limonite outcrops of straight pyritic veins.

Many outcrops show erratic changes from one material to the other with no apparent cause. In examining dumps from former mining operations, pieces showing a surface film of green scorodite will usually disclose arsenopyrite when broken open. In arid climates where the deep water level and slow erosion have resulted in oxidation to the very final stages, scorodite may loose its color and decompose into a white powder, high in arsenic, near the surface.

False Clews To Be Avoided

After hiking many weary miles to investigate such deposits I have come to the conclusion that the mines where "a white powder (efflorescence) coats the walls and poisons the rats" and mines where "they had to give it up because the miners always got sick" and deposits close to "springs that would poison a rattlesnake" are invariably quite devoid of arsenic. In bailing out a shaft in Colorado in a vein carrying the very highest grade of arsenopyrite we found the water teeming with salamanders, or "water dogs." Apparently, the poisonous arsenious oxide is not released from the ore in dangerous quantities by any of the processes of nature.

Gold and silver or silver-lead mines carrying arsenopyrite, which formerly were operated profitably or just failed to make expenses, should, theoretically, now be a promising source of cheap arsenic, but it is my experience that most of these deposits, upon careful sampling, show a low percentage of arsenic. The operation of these mines, though promising as a general mining venture, would entail the moving of such a large tonnage to get any great amount of arsenic that those interested primarily in the arsenic business are loath to embark on such a large enterprise. Ores have been, and doubtless will be, found which represent the happy medium of a satisfactory arsenic content and enough other values to help materially on expenses.

In the course of a reconnaissance of arsenical deposits undertaken by my partner, W. F. B. Berger, and myself, on behalf of the Chipman Chemical Engineering Co., of New York, by whose permission this paper is presented, we had occasion to inspect arsenic veins in all of the western states, in Canada and Japan. A brief description of some of the typical deposits which we examined may be of interest.

Colorado—Between Sapinero and Lake City and near the old mining camp of Du Bois, Pre-Cambrian schists are exposed by erosion, although several little hills are capped by remnants of Tertiary andesites the source of which was the San Juan Mountains to the south. Parallel to the bedding of the schist several veins run southwest to northeast. Dikes of jasper and pegmatite cut across the bedding. Scorodite at the surface changes into heavy arsenopyrite at a depth of 20 ft. in the veins. The ore occurs in lenses 4 to 6 ft. thick at the center. Development has yet to prove how the lenses are spaced. The one semi-developed mine opened up a lens of arsenopyrite as almost straight metal in a streak which could be stripped and broken down clean. The ore runs about $4 a ton in gold.

Idaho—Between Hailey and Bellevue, a series of rather narrow but continuous arsenical veins have nowhere been developed to a depth which would indicate their character below the oxidized zone. The Wood River here cuts through tilted Carboniferous shales and limestones. West of the river these formations come in contact with quartz diorite, which is part of the great granitic batholith of central Idaho. Near and roughly parallel to the contact are the arsenic veins and also silver-lead veins, of which the bonanza Minnie Moore was a shining example. The arsenic veins occur in both the diorite and sedimentaries. In the diorite a vein 2 ft. wide has been drifted on at a depth of 50 ft., and shows a soft brownish-red sand which will run from $8 to $15 in gold and 1½ to 3 per cent arsenic. Occasional boulders of unchanged arsenopyrite disclose the source of the iron oxide and show that oxidation has here removed the arsenic and sulphur and probably concentrated the gold to some extent by residual depletion. I traced the same or a closely parallel vein for nearly 3,000 ft. in the sedimentaries. Maintaining a width of about 2 ft., scorodite, with a sprinkling of arsenopyrite, assaying 28 to 30 per cent arsenic, comes to the surface occasionally, but most of the outcrop consists of the red sand which averages only 2½ per cent arsenic.

Twenty miles northeast of Hailey and nearly in the heart of the Saw Tooth Mountains, there is an interesting occurrence at the Mascot mine. The country rock here is a black carbonaceous schist. Along certain zones in the schist, irregular quartz stringers carry

subordinate quantities of argentiferous galena, and in a high upper tunnel a zone 30 to 40 ft. wide is impregnated with arsenopyrite. The best ore will run as high as $3.60 in gold and 7 per cent arsenic. Workings at a level 340 ft. below have so far failed to pick up the arsenic ledge.

Montana—At Jardine, overlooking the northern boundary of Yellowstone Park, a pioneer gold-arsenic enterprise is being energetically and successfully operated. Pre-Cambrian micaceous schists are cut by large quartz dikes. Parallel to the schist bedding certain what they locally call "strands" are characterized by intense folding, the development of irregular and contorted quartz veinlets and a mineralization of arsenopyrite and some pyrite which gradually fades out in the country rock. The minable width is in many places 8 ft. Broken in this manner the mine-run is said to average 4 per cent arsenic and $7 in gold. Silver is negligible. The mill, which has recently been enlarged to 200 tons' capacity, is said to save about $3 by amalgamation, and from the Wilfley tables and Brown flotation unit obtains a concentrate running 38 to 40 per cent arsenic and $40 to $60 in gold. The former roasting plant, consisting of a reverberatory furnace, a dust chamber, and 165 ft. of concrete arsenic kitchens, has been turned into a refining unit, the first roast being accomplished by a McDougal furnace, followed by large tile kitchens arranged for the mechanical discharge of the crude arsenic. The resulting calcines, which contain about one-half of 1 per cent arsenic, $60 to $100 in gold, and an excess of 38 per cent iron over insoluble, are sold to the East Helena smelter under a favorable contract.

Near Elkhorn a most unusual deposit occurs near the contact between lime and porphyry. Entirely in the porphyry, but rising from the limestone at a depth of 550 ft., a clearly defined pipe 25 ft. in diameter had a core of silver-lead ore which has been mined out. The casing, 4 to 8 ft. thick, carries very little lead, about $4 in gold and silver, and 5 per cent arsenic. To ascertain the character of this deposit at the contact would be an interesting bit of exploration.

Near Wickes an oreshoot which produced silver-lead ore of excellent grade from the upper levels is changing in depth to arsenopyrite carrying gold. A preliminary inspection when the mine had been idle for a long time and most of the workings inaccessible seems to indicate an interesting case of zonal deposition.

Nevada—Near Battle Mountain an uplift of quartzites and limestones is intruded by porphyry. Veins formed along the bedding planes of the uplifted sedimentaries may carry a copper-gold ore, iron and zinc, or silver-lead-arsenic. The Irish Rose mine of the Toulon Arsenic Co. is of the last variety. A vein developed by a tunnel several hundred feet long pinches and swells from 6 in. to 3 ft. The ore is said to run $2 in gold, $8 in silver, and 11 per cent arsenic, in the form of arsenopyrite, and 5 per cent lead.

At Manhattan, 40 miles out from Tonopah, the White Caps mine produces a gold-arsenopyrite ore from irregular fissures and chambers in limestone. The deposit is a striking example of secondary segregation and redeposition above the water level. To a depth of 800 ft. chambers of beautiful orpiment and realgar containing good gold values are encountered. The gold is in a very finely divided state.

New Mexico—In the Magdalena Mountains a shallow prospect shows a ledge 4 ft. wide of hard chert containing crystals and small bunches of arsenopyrite. The chert is near the contact of Pre-Cambrian schists and granite and the overlying Carboniferous sedimentaries, so that it occurs at the same horizon and probably has a similar genesis to the Kelly and other contact lead and zinc deposits at Magdalena near by. The ore will run about 8 per cent arsenic.

Near Hachita and not far from the Mexican border, veins which follow acid dikes cut through ancient metamorphosed sedimentaries underlain by Pre-Cambrian granite. Outcrops show the reddish-brown arsenic gossan and shallow pits expose a vein 1 to 2 ft. wide, of arsenopyrite, scorodite, and quartz, which will run from 18 to 35 per cent.

South Dakota—Arsenic occurs in numerous veins throughout an extensive area of the southern Black Hills near Mystic and Hill City. In uptilted Algonkian slates shear zones along the bedding plans result in gouge streaks and quartz veinlets similar to the schistose deposits already described. The absence of any igneous rocks lends little encouragement for extensive mineralization, and in fact the arsenic is low and the gold values are erratic.

At Keystone, near by, the schistose rocks are cut by great pegmatite dikes, from which an important production of spodumene, beryl, columbite, and tantalite is obtained. In this more favorable locus are several

Aerial tramway tower at Monte Cristo, Washington

In the Cascade Mountains near Monte Cristo, Washington

mines formerly worked for gold. Specimens from the dumps run as high as $10 in gold and 10 per cent arsenic. Some of these mines are now being reopened and a concentrator has been erected.

Utah—At Gold Hill a plug of monzonite porphyry breaks up through limestones, tilting and silicifying them into a hard quartzitic material. Near the contact a deposit 30 ft. wide at the surface runs about 20 per cent arsenic and $7 in gold and silver. It is unusual both on account of its size and the fact that to a depth of 600 ft. the ore is scorodite. At this horizon the ore is changing to arsenopyrite. Probably the vertical extent of the scorodite is due to the deep oxidation sometimes encountered under desert conditions, further influenced by peculiarly local conditions.

Washington—In the Cascade Mountains, east and north of Seattle, there is a belt of arsenical veins which may extend all the way up to the Nickel Plate mine, at Hedley, B. C., from which arsenical concentrates are sent to the Tacoma smelter.

At Monte Cristo, fissure veins cut Tertiary granite and andesite. At one time these mines were operated on a large scale, and a railroad was built in spite of the difficulties occasioned by the precipitous mountains. A smelter, worked in conjunction with the mines, at Everett, on Puget Sound, was responsible for an important production of arsenic. The strongest vein is not wide, but contains an oreshoot which has been presistent to a depth of 600 ft. and for a gross length of about 1,800 ft. The ore contains equal values in gold and silver, in quartz, and arsenopyrite.

Increased Demand for Arsenic as Insecticide Probable

As the boll-weevil army has now invested the cotton region even to its northern boundary and as arsenic is increasingly used for other purposes, such as weed killer, in the glass industry and as domestic animal dips, I anticipate a continued demand and a price which will warrant the development of promising deposits, in spite of occasional serious slumps. The slumps may come from a variety of causes, such as the boll weevil having an off year, but in general it is probable that the demand for arsenic is here to stay. In view of the widespread occurrence of its ores, however, and the prospecting and mining activity now in progress, it is hardly possible that a high level of prices will be maintained. A purely personal figure, used in examining mines, is 5c. a pound in the ore. Accordingly, an ore running $5 in gold and silver and 5 per cent arsenic would be worth $10 a ton. Such a figure, though quite arbitrary, gives in conjunction with the usual vital factors which affect the value of an ore deposit, such as tonnage, grade, width, accessibility, and mining conditions, some basis on which to figure valuation.

As with other new or uncommon ores, the owner or operator is confronted with a market largely restricted to the finished product. Many established concerns will purchase white arsenic, and not a few brokers, all of whom are not reliable. When it comes to ores and concentrates, only a few plants are prepared to treat them and pay a reasonable price, such as the Chipman company mine at Martinez, near San Francisco[1]; the Tacoma and Denver plants of the American Smelting & Refining Co., and I understand, the Toulon Arsenic Co. at Battle Mountain, Nev. Deposits of lower-grade ores not amenable to concentration or so distant from one of the above plants as to incur heavy freight charges will have to await a closer market or install their own roaster.

The roasting of arsenic ores, though simple in theory, is a somewhat technical operation in practice, and one not to be undertaken without competent planning and a thorough study of the tonnage potentialities and mining costs of the deposit which is to supply the ore.

The prospector must bear in mind that quantity is a most essential requirement. One deals with arsenic not in ounces or pounds but in tons, and in districts far from present plants hundreds or thousands of tons must potentially be in evidence. As to grade, another generality may be useful. Where tonnage and other conditions promise a successful concentrating operation, a minimum of 8 to 10 per cent arsenic or a combination with other values to total the same amount would seem to be required. Small veins where concentration would not be possible should make at least a 20 per cent product without excessive hand-sorting. These figures, again, are arbitrary and presuppose an available outlet for the product.

[1]Not operating at present.—Editor.

Cripple Creek: An Inside Story—I

By N. E. Guyot

Prospector and Sometime Proprietor of the First Assay Office in Colorado's Famous Gold Field

N. E. Guyot

IN 1874 H. T. Wood, who had been connected with the Hayden Geological Survey in Colorado, returned to Colorado Springs with the report that ore had been found near Mount Pisgah, in the locality that since 1891 has been known as the Cripple Creek district. About a hundred prospectors led by Wood and B. F. Requa organized a mining district to which they gave the name of Mount Pisgah. Some surface work was done, but, with the exception of one shaft in the very heart of the now proven gold area, no determined attempt was made to develop the camp. This shaft was 100 ft. deep and was sunk by Requa in a dike of decomposed, barren, greenish basalt; it was timbered with quaking aspen poles.

The claim was on the west side of Eclipse Gulch, north from what was developed as the Moose mine; the great Cresson mine today is but a short distance from Requa's shaft, which was obliterated when the railway from Florence was built by D. H. Moffat in 1893. The ground now comprising Cripple Creek district was mapped by Hayden as "a probable silver formation." This is undoubtedly one reason why the pioneers of 1874 abandoned the camp. It is a fact that water was remote from the domelike, grassy hills of Cripple Creek, and it never was a gold-pan camp. The oxidation of the tellurides liberated the gold as flour gold, and it is doubtful if the Wood party ever happened to dig deep enough in the andesite and phonolite formation to reach the characteristic ore of the central section of Cripple Creek, or assays would have been made and the presence of gold determined.

The Hungry Granite of Battle Mountain

I traveled all over the camp in the fall of 1891 when Battle Mountain was a complete solitude. If any vein or ledge cropped in the camp I never saw it; and, even though Stratton's Independence and Washington were vaguely recognized as the making of something great, it is a fact that the Independence ore did not come to the surface. The weathered, irregular mass of hungry looking granite which turned to $140 ore a few feet down did not assay. The Gold Coin granite on the southwest slope of Battle Mountain was barren. In the timbered claims on Bull Hill, not then proved to have value, it is true that some oxidized and crystallized quartz float was found at surface and can be found today. But Wood's party never sunk a hole on Bull Hill. Eclipse Gulch had a little water; it had little groves of quaking aspen, and here is where they dug. The camp went back to the wilderness.

In 1881 Henry Cocking (so he told me in 1891), a Cornish miner who had been all over Colorado and who represented on grubstake a music merchant in Denver, named Montelius, went to what is now known as Poverty Gulch. He drove a short tunnel directly south from the El Paso-Gold King mine in iron-stained rock; then he stopped. This tunnel, if carried a short distance further, though only a "surface" adit, would have run into the El Paso-Gold King oreshoot. In April, 1884, Mr. "Chicken Bill," otherwise S. J. Bradley, from Leadville, deliberately instigated a rush into the district through the Teller placer, which, to all accounts, he had salted, probably with placer gold from the South Park country.

How "Chicken Bill" Escaped the Noose

Five thousand men were in and out of the district in ten days, and if they had been able to corral Mr. "Chicken Bill" they would have hanged him. I was informed by Riley Shideler in 1891 that the Teller placer was on the east slope of Mount Pisgah, where today sleep thousands of those who made their final stand at Cripple Creek.

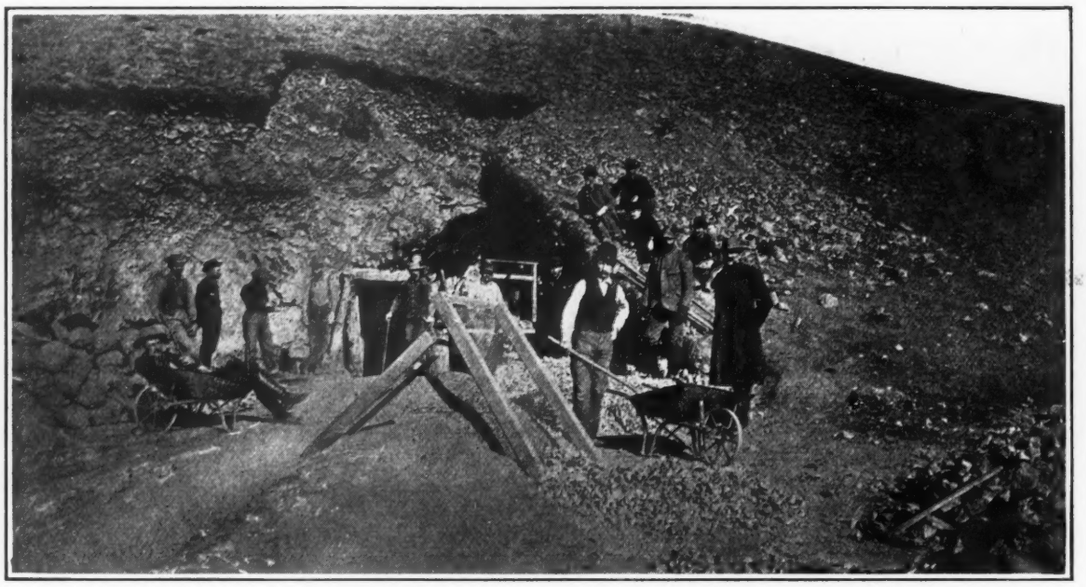
The Pike's Peak placer, located in 1891 by Riley Shideler north and west from the present town of Cripple Creek, actually had a little bright, distinguishable gold in the wash from the hill above. It is still a non-producer of gold.

I never saw any good pannings from any of the few water-courses in 1891, though the big open cut on the Great View lode on southwest Gold Hill panned handsomely. It was assaying that did the trick for Cripple Creek. Wilson Creek below the Independence, Portland, Ajax, Gold Coin, and Strong mines never panned a color for me and my daily companion in those early days, who was W. L. Fyffe—Lafe Fyffe, a one-eyed, experienced Cornish miner from the Breckenridge district. What was subsequently the Gold Coin mine was decorated the first day I ever saw the ground with a neatly planned 2x4-in. stake on which was fluently and comprehensively described a lode claim located by Charles Mitten, of Canyon City.

In 1894 a wagon load of alleged ore from the Gold Coin was left all night in front of my office on Second Street in Cripple Creek. I took a grab sample. It ran a "trace" in gold. The wagon was decorated with a banner which stated "Ore from Gold Coin Mine. Buy a lot in Victor." Wood Brothers were booming the new townsite, a rival to Cripple Creek. Nevertheless, subsequently, the Gold Coin did become an important mine. Ore location stake which I saw in the early days, painfully and carefully written by an illiterate prospector claimed "all dips, spurs, and angels of minneral barren rock for 1,500 feet."

In the winter of 1890, Robert Womack, employed on the Broken Box ranch by the firm of Bennett & Myers, of Denver (a part of this cattle ranch was platted as the town of Cripple Creek in 1891), dug a 10-ft. hole on the shoulder of the slope above the tunnel which Harry Cocking had run in 1881.

Womack took samples to Colorado Springs, and Pro-



El Paso-Gold King mine in September, 1891

Original workings in Poverty Gulch. The claims were located by Bob Womack, the "discoverer" of Cripple Creek. "Len" Jackson, sheriff of El Paso County, is garbed in the frock coat, as befits his office.

fessor Lamb assayed them GOLD! This rock ran high and the subsequent large production of the El Paso mine, renamed Gold King by Fred F. Frisbie and E. M. De La Vergne, of Colorado Springs, may no doubt be traced to Cocking's tunnel, since Womack was not a miner and did not locate any other worth-while property in the camp. De La Vergne and Frisbie took a lease and bond on the El Paso for a few thousand dollars. Poor Bob Womack died broke!

It was in the summer of 1891 that Judge William J. Kerr, of Pueblo, a lawyer, an orator, and an enthusiast, made a trip to Cripple Creek and displayed in Pueblo a tiny vial containing probably 25c. worth of gold. At this time the tenderfeet in Colorado, especially those in Colorado Springs and Pueblo, who had been loaded up with prairie-dog town lots and the Kansas brand of boom led by the celebrated "Coin" Harvey (he was a good scout and a good hustler), began to sit up and take feverish notice of the reported gold find at Cripple Creek.

When Judge Kerr displayed his "two-bits'" worth of gold in his little picayune bottle, all the old pioneers of the San Juan, Leadville, Custer County, and the rest of the camps rose out of their mossy beds and howled, "Another Mount Pisgah fake!"

I had retired from the "diplomatic corps" of the old Pueblo smelter in 1890, having accumulated a large fortune during the five years I worked for the smelter and having also cleaned up a few dollars selling arroyo-gashed acreage to Denver boomers who were in the lot business. Also, at odd times, when "Old Man" Geist did not run me out of the yard, I had gained a casual, if not a cursory, knowledge of ore. As a matter of fact the old Pueblo smelter had ore from every camp from Montana to Old Mexico, with Cedros Island, in the Pacific, thrown in for good measure; and any ore buyer or bidder in the Denver market who could not learn considerable about ore of all kinds would have been a fathead, net.

Big Herman Schlapp, with his squeaky voice; the Baron Ropp, Philip Morse, Johnny Allen, Sam Bridge, E. P. Mathewson, and all the metallurgical talent of the P. S. & R. cursed the day when the Chicago clerk blew in and got "stuck" on ore and bored them about it. But they were kind and patient all the same.

I went to Cripple Creek in September, 1891, and pulled up my horse at Shideler's placer on a bleak afternoon. Shideler was courteous, and panned some gravel in which gold "could be seen (as the prospectus writer says) with the naked eye." As if man ever saw gold with his eyes shut!

Wesley Gourley had the "hotel." It was a log shack about 20x30 ft. where all rolled in on the floor. A small office about 10x10 ft., with the usual box stove banked in with dirt, was filled, standing, that night with doubtless the most unsophisticated lot of tenderfoot mining men who ever congregated in the world. De Le Vergne and Frisbie had a log shack up in Old Town (they say that "Hot Time in the Old Town" originated there in 1892). In that bunch in Gourley's Hotel there wasn't a miner. One chap from Boston became a partner of mine. He had been selling horseshoe nails on the road and went broke. To this day I will say for Jack Mullin that he was a first rate smoker and a fine poker player.

Cripple Creek's First Assay Office

That night I went up to Frisbie and De La Vergne's cabin, and in their cook stove they roasted a chunk of hungry looking rock. By Saint Crœsus! there was gold in it, beautiful little pin-points. I saw it with my little microscope in a jackknife given to me by Alva Adams in 1885. I still have this knife, and Will Merriss, now secretary of the A. S. & R., had the mate to it. We used to walk O'Leary fashion together in the gymnasium back east in 1870. Alva is dead. His son is a Senator. Merriss is a capitalist, and I am still prospecting—among other things.

I remained in the camp for a week, landed in Oscar Dobson's hotel in the forks of Squaw Gulch and Cripple Creek, bunked on the dirt floor with Lafe Fyffe and looked the place over with him. I took to the Pueblo smelter twenty good samples from the twenty leading prospects, and the results were from a trace

to 68 oz. in gold per ton, with modest assays in between. Then I bought a complete outfit, except furnaces, from the Pueblo smelter, and about Nov. 10, 1891, with Jim Doyle as assayer, we "blew" in the first assay office in Cripple Creek. Notice the sign in the picture.

Doyle—peace to his ashes—had been at Anaconda, Mont., with Ropp, and had returned to Pueblo when I engaged him. I can still hear the curses of Stratton, McKinnie, and nearly all those who brought in rock to be run. It was trace, trace, trace, with once in a while a high result to keep up the excitement. I don't believe there was a man in the district who knew a thing about the ore or how it occurred or when until the assay told the story.

Of course, later on, as depth was reached, they got into bonanza high-grade in the Independence, Portland, Gold King; but, on the other hand, the rotten basalt in the Raven that ran high in gold, the rusty-gold high-grade from the Moose, the particularly penurious looking granite from Stratton's surface, all had us guessing. Gold King sent a small car to Pueblo. A few tons of it went over 10 oz. gold. H. W. Barry shipped two cars from his Anaconda mine on Gold Hill to Denver early in 1892. It ran about $35 per ton, with five tons of $210 ore. The stock went booming. From the Orphan Belle was shipped two cars. It was a trace. Gray copper in it, not tellurium!

Kind Words for Benjamin Sadtler

But to get back to the beginning. If there ever was a technical man, engineer, or metallurgist except Benjamin Sadtler, of the old Pueblo smelter crowd, who openly indorsed Cripple Creek prior to 1894 when the Independence was in bonanza, I wish he would now come forward and show me. Of course we had "Windy" Ford and his partner Anderson, who owned the Australia and Little May, on Beacon Hill, and whose mining experience prior to their coming to Squaw Gulch in 1891 had been gained in the retail horseradish business in Wichita, Kan. The Ford claims afterward were the El Paso Mining Co. properties—rich! "Windy" Ford still lives in Los Angeles, and I will now kindly say for him that he is the best-intentioned liar I ever met.

Good Assays Got the Business

One day Bill Eaton came into my assay shop and got his certificate. He looked at it and gave a snarl and said "By ——! I don't know whether you are a damn fool or a damn fox." Another customer gone! In the meantime old man Dana, who (so help me) had a typical tinsmith's outfit, used to make "assays" and gave big results on everything. He got the business and he kept them digging in the dark days of 1892 when the Pharmacist, on Bull Hill, with its small output, was the one mine of the camp.

This reminds me of Terence Coyle, who in an adverse suit in Colorado Springs admitted that he was by profession "A locatorrr of frrractions," and on being asked by Senator Thomas if he had any quartz in his discovery shaft, said that he did have quartz in his discovery shaft. "Well, Mr. Coyle," said Thomas, "What is quartz?" "Rrock," answered Coyle. "Ah, so quartz is rock, is it, Mr. Coyle. Now, please tell the court what rock is." "Quarrtz!" replied Coyle.

One day "Windy" Ford came to me and said he had a thousand-dollar assay out of the Little May. "Fine," I said, "Who made it." "Danny," said he (Dana). "Danny be damned!" said I. Ah, those were happy days!

George Carr was the foreman of the Broken Box ranch. He was the man who distinguished himself at the first dance given in Squaw Gulch by the Squaw Gulch Amusement Club, which was actually incorporated by H. W. Barry, of the Anaconda mine. It was stipulated by the *directors* that no "chippies" should be allowed in the hall. Carr was floor manager and had a voice

Cripple Creek's first assay office in September, 1891

Reading from left to right the gentlemen are: Oscar Dobson, Jim Doyle, "Old Man" Wanamaker, from Tiffany's; William Reed, and N. E. Guyot. Later the district supported 100 "assay offices."

like six bulls of Bashan. Up comes a little blacksmith while Carr was bellowing out that peculiar jargon of the cowboy dance, and shrieked "Say, George Muldoon has a chippy in here, and I want you to put her out." "Put her out yourself, you —— —— ——" said Carr, and went on roaring without hesitation.

"Anaconda" Barry was from Idaho. He hired no miner who could not play an instrument in a brass band. Well, he had a handsome lot, all in blue shirts and cowboy hats playing like blazes on the hillside the day Judge M. B. Gerry, of Pueblo, and I rode up to go over my claims that "Doc" Lauterman had jumped. That was the day they shipped their first car of ore to Denver. "Well, I'll be damned," said the Judge, "I have seen a lot of peculiar minin', but this is the first time I ever saw them mine with a brass band."

Judge Gerry is the jurist who tried Packer the Cannibal, who killed and ate six or eight men near Lake City in 1877. When the jury brought in a verdict of guilty the Judge made himself famous. "Stand up, you man-eatin' son of a —— and take yo' sentence.—Now, see here, you monopoly mawed coyote etc., etc." This speech is authentic and a classic. Gerry admitted it to me. Thomas and Gerry were our lawyers, but the jumper beat us. First lawsuit in Cripple Creek district, but not my last.

The Mary McKinney mine, on Guyot Hill, shipped the first ton sample of ore sent from the camp to the Omaha & Grant smelter. It ran about $22 a ton. Frank Castello, of Florissant, showed me the returns in '91. George Carr ran for first Mayor against Doc Whiting, the first doctor in camp. Carr got "locoed," and roped a lot of citizens on the street. He was defeated. "Timberline" Fariss, of Pueblo, was a prominent citizen. He was 6 ft. 8 in. tall.

One time early in '92 Charley Reuter, H. C. Joy, of Dunbaugh & Joy; O. H. P. Baxter, and I sampled the Strong mine, on Battle Mountain. Strong had Omaha & Grant showing over an ounce gold in a ton he sent them. We said, pick out the ore. He did. Reuter, Joy, and Baxter took their samples to Pueblo. "Trace, trace, trace!" I had Will Armour from the Boulder tellurium belt assaying in my shop. In came Sam Strong. "How did it go?" said he. "Two dollars" said I. "You are a —— liar," said Strong and walked out. He never spoke to me after that. I had an option on the Strong property for $15,000. Six months after Lenox & Giddings paid $60,000 for it, and it produced millions.

There was a thin, rich scale of manganese on one wall of that fluorite dike, and he got it in the Omaha & Grant sample but not in ours. None of us knew, but old "Pop" Kearney, of Boulder, found it and cleaned $45,000 on the deal. Reuter and Baxter were old, old miners—I don't think.

The Old Guard Fell Down

Stratton was a builder; Burns a locomotive fireman; Harman a miner; Doyle a ditch digger. The old guard from the San Juan, Leadville, Georgetown, and Aspen fell down almost entirely. But I think Deveraux, of Aspen, was the man who took a lease and bond on the Buena Vista, afterward the Isabelle. Of course, Moffat got in right through the consolidation of the Anaconda, my company, the Coronado, and others by L. D. Roudebush, of Creede and Enterprise flotation fame. That's when I cut my teeth on turning a good property over to a big man for a block of stock. Skinned! Never again. In the early part of 1892 I sent in a lot of tenderfoot, boom-mining stuff to the *Pueblo Chieftain* and the *Colorado Springs Gazette*. They printed it, and then editorially denounced the camp, which did not even have a real name. The first post office was Fremont, then Moreland, finally Cripple Creek. And after that, when there were 40,000 people in the district, they had post offices and towns named Victor, Goldfield, Altman, Cameron, Gillett (where D. C. Jackling began), Lawrence, Barry, and Independence.

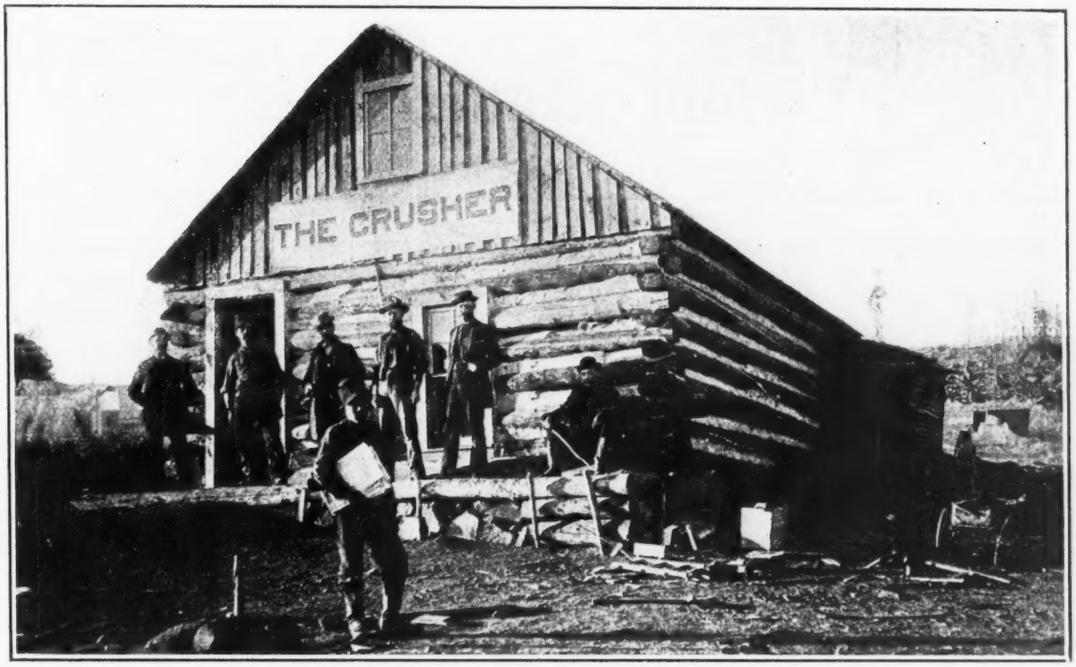
Half the Independence Optioned for $25,000

In the fall of 1891 W. W. Allen organized on paper the "Guyot Syndicate in Cripple Creek," his partners consisting of Ed Billings, Jim Hammond, W. W. Allen, L. S. McLain, and N. E. Guyot. None of the other four ever put up a copper. Christmas Eve, 1891, Allen, Billings, John J. Crooke (God rest that old pirate!), Hammond, McLain, and myself had dinner at the Grand Hotel in Pueblo. We had plenty wine on the table. Crooke sneered at Cripple Creek, and pointed to his old Golden Fleece mine, at Lake City, as an instance of the treachery and pugnacity of tellurides. I argued for the camp. Finally he said, "Guyot, you are only a damn fool." In my pocket I had our option for half the Independence at $25,000! There was the Guyot Syndicate. I had all the west slope of Beacon Hill located as the W. W. Allen Lode, E. C. Billings Lode, J. E. Hammond Lode, L. J. McLain Lode, and Baby Lode. I let the option slide. I did not do the location work on the claims, and forfeited them, because I began to think these Ed's and Bob's and John's were right. The camp no good; Guyot was a damn fool!

I organized a company on a claim on Gold Hill called the Anaconda Extension. I gave 55,000 shares each to Bob Billings, W. W. Allen, Senator Tabor, Pete McCourt, his brother-in-law, W. N. Byers, who established the *Denver News* in 1859, and a few bankers. All were directors, but I couldn't get a meeting! Byers and Woodbury handed the stock back to me and resigned. I paid Allen $200 for his. McCourt, the Tabor estate, Billings, and myself sold to Stratton for $55,000. I abandoned claims all over the camp. The wise ones were the fools. My hunch was good!

In 1893 Moffat built the Florence & Cripple Creek R.R., the only trackage built in the entire United States that year, though Colbran and Hagermann, of Colorado Springs, were busy on the branch of the Colorado Midland from Divide to the camp. They reached Gillett that year. In 1892 the elder Carter H. Harrison, of Chicago, passed through and presided at a railroad meeting in the town of Cripple Creek. I can still see that bunch of tenderfeet miners guaranteeing big tonnages to Colbran, who were there in the interest of the Colorado Midland, of which he was manager. I can also see the bunch down at the Iron Clad dance hall jubilating with the dance-hall ladies.

The first newspaper was the *Crusher*, established by Burt Pottinger, recently from Kansas, Pueblo, and one of the Coin Harvey-Tom Richardson group of boomers who undoubtedly did much to influence Jay Gould in building the Missouri Pacific to Pueblo. I was the "expert" who furnished Pottinger with the news of developments. It would be amusing today to read that stuff which was based on enthusiasm. It would also be interesting to republish the denunciation of the



Where the first newspaper in the camp was published

The *Crusher* was established by Burt Pottinger in 1892. N. E. Guyot was the "expert" who furnished mining copy for this excellent journal.

Colorado Springs Gazette and its corespondents and the gibes of the *Colorado State Press*. Pottinger left the camp early in the day, and E. Chapin Gard succeeded as editor. Gard was a combination of wit and vindictiveness, and did not care much for the camp. One day he published a page wherein he scolded nearly the whole bunch of "prominent mining men" who dwelt in the Clarendon Hotel, in Old Town.

Why the *Crusher* Changed Hands

Gard, referring to the "Clarendon," said "This curious hostelry is run by a red-faced, cock-eyed Sheeny, who ought to be back in the Missouri flats pulling cockle burrs out of a cornfield." To repeat more would be to libel some pretty prominent mining men of today, but the paper changed hands next day by a foreclosure and peace was restored.

Carlton Wouldn't Feed the Bull on Credit

Joe Wolfe, the aforesaid proprietor, pulled off a bull fight at Gillett in 1894. It was not much of a bull fight and the matadors and other talent imported from Mexico landed in jail at Cripple Creek for cruelty to animals. The cruelty actually consisted in Wolfe's not having money to buy hay to feed bulls. A. E. Carlton, of the present big Cresson mine, refused to credit Wolfe for the hay, Carlton then being in the hay, feed, and coal business. In 1890 the Baring failure occurred in London, and at once a world panic ensued. The Colorado real-estate boom promptly busted, and Colorado Springs, like Denver and Pueblo, were populated by real-estate boomers like C. L. Tutt, W. P. Bonbright, et al., and also there was a contingent of young lawyers like H. M. Blackmer and young "bankers and brokers" like Sherwood Aldrich. The banking contingent was represented by the Howberts and Jackson, all old-timers, but friendly to Cripple Creek and inclined to suspect its genuineness. Colorado Springs, with its idle realty corps, got behind the camp and made many millions. One of the early promotions was the C.O.D. mine, in Poverty Gulch, in which C. L. Tutt, Spencer Penrose, and others were interested. They issued a prospectus. About the best thing that could be said of the C.O.D. then was this: "A good wagon road to Colorado Springs runs over the property." Promptly the jokers of the El Paso Club and Broadmoor, as it was then, got together and issued a printed replica of the prospectus. The public was invited to invest in stock of The Tenderfoot's Delight Mining, Milling & Transportation Co. They said: "The mine is elevated two miles above sea level and consequently the grade of the ore expected to be found will be very high. A large flow of water exists in this great mine, which, if pumped to the surface to a canal which is projected to Colorado Springs, will form an important artery of commerce . . . ."

Well, Burke & Troy came along, took a lease and bored. They shipped lots of ore, and the C.O.D. was sold in Paris for several hundred thousand dollars. In these days if one cannot run an engineer to his property in a touring car there is nothing doing. In the winters of 1891, 1892, and 1893 the trip from Denver or Pueblo to Cripple Creek was tough. It took from 4 a.m. to 9 p.m. with waits at Colorado Springs and Florissant, and one fell off the stage at Joe Wolfe's hotel coated with dust and half frozen after the blizzards that blew off Hayden divide and the petrified forest lands thereabouts.

In 1892 Ed Holden, who initiated the Guggenheims into the smelting business, in association with Charley McNeil, built a small mill below Lawrence. It did not go. The career of McNeil, Jackling, Penrose, Aldrich, and Blackmer began in the early days of milling and mining in the Cripple Creek section. There are those who are born to wealth as sure as the sun rises.

To be concluded

Useful Operating Ideas

Fastening Roll Shells at Timber Butte Mill

By W. J. Tait

The practice that is followed in fastening roll shells at the Timber Butte mill, Butte, Mont., as described in the following, has been developed over a period of time, and has successfully met some of the problems involved in fastening roll shells. The rolls are 55x18 in. and are employed in crushing a feed of ¾ in. to 1 in. in size through ⅛-in. mesh screen in a closed circuit with screens. They were originally furnished with the usual tight and loose cores for shrinking on the shells. One-piece cores and single-taper shells were also tried. The practice was to shrink 0.001 in. per inch in diameter, and this shrinkage was gaged by setting the cores and shells tightly together, heating the shell and driving up the cores to a measured distance.

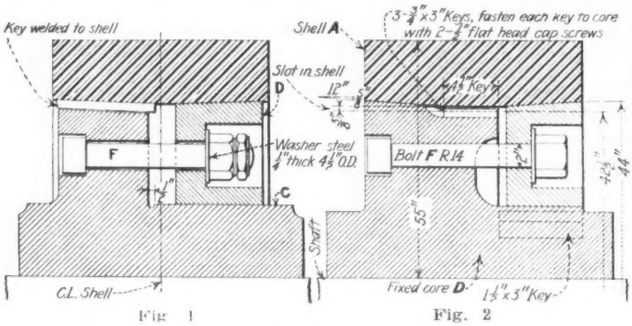


Fig. 1 Fig. 2

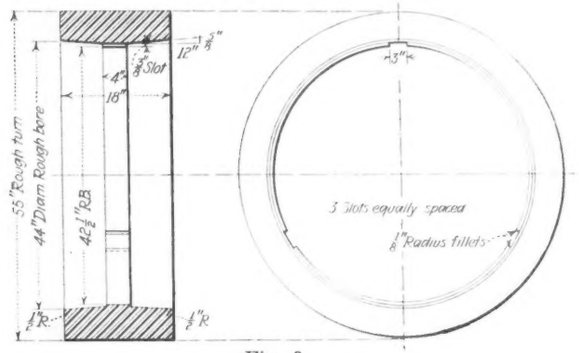


Fig. 3

Details of the method of fastening roll shells used at Timber Butte mill

Fig. 1—Assembly of double-taper core and shell. Fig. 2—Assembly of shell *A* and cores *C* and *D*. Fig. 3—Roll shell showing keyways cut in it.

During war times difficulty developed from the roll shells slipping or breaking when they were still of a considerable thickness. This was due to the shrinkage being too little or too great. Much breakage was also caused by the employment of inexperienced men and the tendency to rush the job without proper care in fitting. The fire risk necessitated doing the work outside of the mill building, and severe weather always brought about complaint from the men. The shells, by slipping, destroyed the faces of the cores and thus necessitated core renewals, as shims are very difficult to hold when the core faces become worn. The method of fastening by wooden wedges was tried, and one set of cores tha were turned down for the wedges is still in use and gives satisfaction when the shell is carefully wedged.

It was thought that a key for positively driving the shell with the cores supporting the crushing load should prevent both slipping and premature breakage, since the shell would be under tension from the shrinkage. The first plan tried was the building up of a key on the inside of a shell by arc welding. Test pieces were made and tried out under the steam hammer. The most successful of these were made by filling between two strips of steel clamped on the shell. The strips furnished edges and faces on the key without the necessity of machining. In breaking off the keys under the hammer, the keys pulled away part of the original shell with them. The keys put on the shells were 3 in. wide and ¾ in. in height, a keyway being cut in the fixed core. See Fig. 1. The loose core was rammed up tight and held by the core bolts. The first of the shells fastened in this way broke at the key, the thickness of the roll shell being about 1¾ in. Inspection seemed to indicate that the welding process altered the structure of the shell under the key. The second shell wore down to about 1 in. in thickness when it was discarded. Inspection showed that a crack had started in this shell at the key.

Our present plan is to use a central rib and three keys fastened to the fixed core by flat-head capscrews, Fig. 2. Corresponding keyways or slots are cut in the roll shell, Fig. 3. The shell is rammed right on the fixed core; the loose core is rammed tight into the shell, and the bolts through the cores are then drawn up. The plan has been very successful. One great advantage is that no special skill is required to secure satisfactory fitting. The time necessary for a change of shells is about two-thirds that required for shrinking or wedging. Failure of the shells happens through breaking when worn thin, the shell usually dividing into three pieces.

Pipe and Pipe-fitting Facts

By W. F. Schaphorst

Screwed fittings are usually satisfactory for low-pressure work and even for higher pressures where joints are carefully made. Seldom should the 6-in. pipe size be exceeded with screwed fittings. Larger sizes are likely to leak, because of the difficulty of screwing up tightly. Beyond 6-in. sizes flanged fittings are always to be recommended. Manufacturers and users of fittings have finally agreed on one standard, the "American Standard." To be safe, this standard should always be specified where possible. Complete data covering the American Standard can be secured from the

American Society of Mechanical Engineers or from recent mechanical engineering handbooks.

To determine the approximate bursting strength of a fitting in pounds per square inch, multiply the tensile strength of the metal by six, multiply that by the thickness of the metal in the body of the fitting in inches, divide by the internal diameter of the fitting in inches, and divide this result by ten.

In tightening bolts never slip a pipe over the wrench handle to increase leverage. Wrenches should always be short enough so that the bolt tightened will not be over-stressed. A good rule to apply for determining the proper length of a wrench is to multiply the size of the bolt by 15. The result is the length of the wrench in inches. Thus for a half-inch bolt use a 7½-in. wrench, for a one-inch bolt a 15-in. wrench, and for a 2-in. bolt a 30-in. wrench.

For steam piping the factor of safety should be at least six. The relative strength of piping is, roughly:

	Steel	Wrought Iron
Seamless, strongest	2	...
Lap welded	1.9	1.1
Butt welded	1.5	1

Extra heavy pipe is better for bending in small sizes. It is not so liable to split and gives a better bend. Riveted pipe is weaker than lap-welded pipe. Spiral riveted pipe averages about half the strength of lap welded. Straight riveted pipe is weaker than spiral riveted, develops more friction, and should not be used for hot water, live steam, or high-pressure hot liquids or gases. Copper and brass pipe is used because of its non-corrosive properties. Brass pipe in standard iron pipe sizes is most convenient to use, although it is usually heavier, and consequently more costly. The thinner tubing should not be used for high-pressure work, because it is not safe. Copper should not be used in high-temperature work or high-pressure service, because it is greatly weakened by high temperatures and has low strength. For example, it is only 85 per cent as strong at 360 deg. F. as at ordinary temperatures.

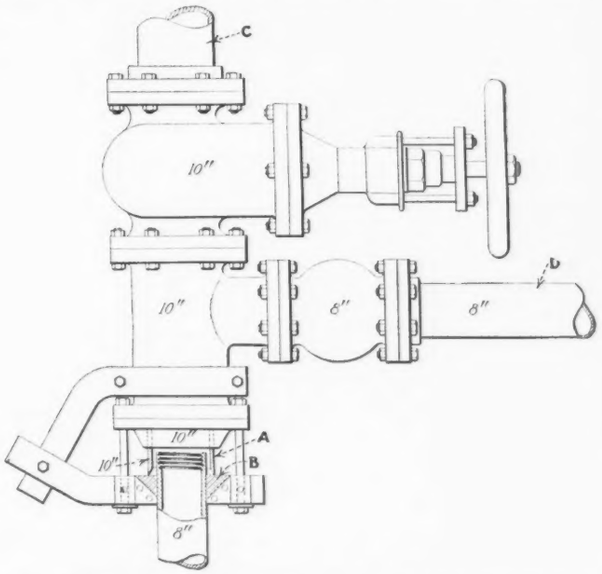
According to the Bureau of Standards, charcoal iron expands 0.000006861 in. per degree F., and Bessemer steel 0.000006989 in. in steam pipe lines exposed to the weather; however, the expansion is seldom if ever as great as the theoretical, on account of the lower outside temperature, and consequently it is safe to use the smaller coefficient, 0.0000067. To compute the expansion of any given iron or steel pipe of known length, use the formula $E = 0.0000067\ tL$ where E is the expansion in inches, t the difference in temperature in degrees F., before and after expansion, and L is the length of the pipe in inches.

Rig Used to Extinguish Burning Gas Well

By Mark R. Lamb

Well No. 1 of the Solano Company, Comodoro Rivadavia, in Argentina, came in unexpectedly, though bailing was in progress, and got out of control because the men in charge were admittedly water-well drillers. Subsequently, an experienced man, Augustin Rosas, has been placed in charge of the work. As soon as the well came in, a chance spark or a broken light wire ignited the gas. The derrick was ruined. Standard Oil loaned a Holt tractor to pull the wreck from the flames. The gas was coming from an eight-inch flush-joint Mannesmann casing from which the valve had been torn away. The casing stood four feet above the ground. The stream of gas was like a bar of steel. The spouting pressure was 26 lb. per square inch, equivalent to about fifty million feet. The flame was 150 ft. high and exceedingly hot.

The well burned for two months, while the people in charge invented extraordinary methods for putting it out, and all the neighbors said they could do it. The worst scheme, and one which was actually tried, was to



This sketch shows how the valves and connections were arranged in the effort that succeeded in extinguishing the burning well

build a funnel of sheet iron and tip it over the well, in the expectation that all of the gas would go out of the top. The funnel was provided with two outlet valves, which were to be gradually opened while the valve in the neck of the funnel was to be closed. No provision was made for the gas which might decide to go down under the edge of the funnel. When it was tipped over the well, the flame shot out for 50 ft. around the funnel, which curled up in the heat. The valves melted in a few minutes and the steel cable did likewise.

The only person who had the right idea was the wife of an engineer who said: "If they would just put something over the well and stop the gas for an instant, the fire would go out." The usual crop of "stovepipe" suggestions were made. The plan finally used is shown in the accompanying figure. Around the eight-inch pipe a clamp with a ring of lead, *B*, was tightened. A 10-in. flange was provided with a sharpened nipple and was bolted to a 10-in. tee to which were bolted 8 and 10-in. valves as shown. The tee and valves were placed in position by means of the hinged clamps.

The velocity of the gas was so great that it was possible to work close to the jet, as the fire was not lower than 12 ft. at any time. This made it possible to place the lead collar and clamps and arrange for tipping the set of valves into position. This was done without trouble and from a distance by means of ropes. The holding-down bolts were then placed and tightened, the side outlet 8-in. pipe was connected, the 8-in. valve was opened and the 10-in. valve closed; whereupon the "fire went out."

Discussion

"Cheap South American Copper"

THE EDITOR:

Sir—The comparison of South American copper producers with a group of the largest low-cost producers in the United States, made by Arthur Notman in "The Bogey of Cheap South American Copper," which appeared in your issue of May 17; "The Return to Normal of the Copper Industry," in your issue of Sept. 20, and his letter in your issue of Oct. 18 indicate that the competitive advantage is decidedly with the North American group. This view is summarized in Mr. Notman's letter which appeared in your issue of Oct. 18, as follows:

	Earnings per Pound Available for Dividends, Cents	Capital Cost per Pound (Depletion) Cents	Profit per Pound, Cents
North American group.....	4.7	2.9	1.8
South American group.....	5.6	5.8	(a) 0.2

(a) Loss.

The basis used is copper at 14c. in New York.

Obviously, the value of Mr. Notman's conclusion hinges upon the accuracy of his allowance for "depletion," which, for the South American group, is more than the cost of production and amounts to 41.5 per cent of the market value of the product.

It is not clear to me whether Mr. Notman bases his figure for depletion on the book valuation of the companies or on the market value of the securities. He does not give details for all three South American producers (Chile, Braden, and Cerro de Pasco) but only for two of them. An average of detailed figures for the three companies which compose his "North American group" (Utah, Miami, and Nevada), if based on the Tables III and IIIa of his article in your issue of Sept. 20, shows 2.45c. per pound on a basis of book values of 3.38c. per pound on the basis of market price of the securities. His figure of 2.9c. is halfway between the two. However, in another place he states his point of view distinctly (his article in your issue of May 17), as follows:

"Today to establish a copper production of 100,000,000 lb. per annum in the United States usually means an investment of $30,000,000 to $40,000,000; and a similar venture in South America with added facilities for transportation, power, housing of employees and other accessories, which inevitably must be supplied by those undertaking the investment, will require about two times this amount."

It is clear that he means that since the actual cost of developing a large copper producer in South America is twice what it is in North America, a proper charge for amortization will be twice as much in South as in North America.

If book assets be taken to represent first cost of the enterprise, Mr. Notman's contention is borne out by the figures he gives for the two largest producers, Utah and Chile. However, what do book assets amount to?

Obviously, they are a list of items partly made up of liquid assets, definitely determinable, and partly of more or less arbitrary values given to property and plant so as to make the total of the assets balance with the total of the liabilities. The latter in turn include the book credits for surplus and reserve accounts; but also the bonded debt and the face value of the capital stock. The stock may correspond to actual money contributed dollar for dollar, or to values contributed worth that amount of money; or the amount may be arbitrary. As the part of the liabilities represented by stock does not necessarily represent investment of actual money, the assets which are made to balance them may be the result of a sum based on arbitrary values.

In the case of Chile Copper, which is the largest of the South American producers, and makes nearly half of the total production of Mr. Notman's South American group, the bonded debt and capital stock together make up 87.5 per cent of the liabilities; and the capital stock alone makes up 60.5 per cent.

If I am correctly informed, the total cost of the purchase of the property and its equipment (aside from payments to those instrumental in organizing the enterprise) was completely covered by the proceeds of the bond issues, amounting to $42,353,250; the $95,000,000 of capital stock did not go into the company's treasury as money, and did not represent an expenditure by those "undertaking the investment," if by that Mr. Notman means the "organizers."

Since, under American procedure, stock may be issued to any amount of face value and distributed as the organizers see fit, and does not, as under the laws of most countries, carry with it a responsibility on the part of the treasurer of the company to receive payment of the full face value in money contribution, there was nothing to prevent the organizers of Chile Copper from issuing say $950,000,000 in stock, instead of $95,000,000 and distributing it in the same proportions that they did the present issue. In that case the undertaking might have been financed with bond issues, just as was actually done, and have been in the same competitive position, as a producer, as it is today. Presumably the shares, if of the same face value, would be worth $3.40 a share on the market instead of $34 (except for the effect of the convertibility factor in the bonds). But the total liabilities of the company would have been increased to six and one-half times their present amount, as would also necessarily the assets, and, if based on book assets, the allowance for amortization would amount to 40c. per pound of copper produced.

From the point of view of the organization of copper production it is the actual first cost of property, equipment, and working capital to the organizers which would determine the undertaking of new ventures.

Once in operation the competitive strength of producers would be measured by the cost of production, including service on the bonded debt, but exclusive of amortization and interest on the capital stock, since operation may continue without dividends.

In the case of Chile Copper, if amortization be calculated on the actual expenditure of money on the investment—that is to say in this case on the amount of the bond issues, or $42,353,250—and if the same rate of interest be charged as that used by Mr. Notman (namely, return of capital in twenty years at 5 per cent, or 8 per cent per annum), then the charge per pound of copper produced (in 1923) would become 1.66c. instead of 5.8c. The operating profit remaining after this deduction, or 4.64c. per pound, would be higher than that given for any of the other copper companies in Table III of Mr. Notman's article in your issue of Sept. 20.

Furthermore, the actual cost of establishing a copper production of 100,000,000 lb. per annum in this case would seem to have been about $20,000,000 instead of the $60,000,000 or $80,000,000 estimated by Mr. Notman; that is to say, half as much as what he states it to cost in the United States instead of twice as much.

Profits on Previous Production Put Back

As Mr. Notman properly suggests, the purchaser of securities should figure for himself the return of his capital within a reasonable period with a sufficient rate of interest to cover risks. But surely it is not correct to assume that because dividends received beyond twenty years from now must be charged with discount which will reduce their present value to far below that of dividends received this year, therefore they can be disregarded in a comparative valuation. If one figures capital as amortized in the first twenty years with an 8 per cent per annum charge, then dividends received after that should properly be discounted with only 5 per cent per annum, and the present value of a dividend received in twenty-one years will be roughly 36 per cent of a present payment; and a dividend received thirty years from now 23 per cent.

Moreover, if one assumes the Chile Copper Co. to have fifty years of life assured at the present rate of production, it is reasonable to assume the property as divisible into two parts, one a fully equipped deposit with twenty-five years' life at a rate of production of 200,000,000 lb. per annum, and the other a reserve now unequipped, but capable of being equipped to produce another 200,000,000 lb. per annum for twenty-five years. Presumably this reserve could be fully equipped for less than the cost of the present producer, which, as we have seen, amounted to $42,000,000, including the cost of the property. If it be assumed that the second installation were to cost, say, $35,000,000, and that this cost could be covered by a further issue of bonds requiring an annual interest payment of $2,250,000 (proportional to the debt service on the present issues), then if an operating profit of 6.3c. per pound were made, in accordance with Mr. Notman's figures, the company would make an additional profit available for dividends of $10,000,000 per annum. This is equivalent to more than $2.50 per $25 share per annum—10 per cent of the face value, which profit would be over and above what is now available for distribution as dividends.

The potential value of this reserve to the company would be its earning power, discounted at a proper rate of interest to cover deference of profits; that is to say, the present value of the earnings possible from this reserve should be discounted with a proper rate of interest to cover the period required to put it on a full producing basis.

Personally, I consider Mr. Notman's figure of 5 per cent interest, exclusive of sinking fund, too low, but for the sake of comparison I will use that basis for interest and 8 per cent to include sinking fund which would amortize the present value of the profits in twenty years; also, I will assume that the addition of a new 200,000,000-lb. producer to the list of present-day producers would not swamp the copper market, since from the point of view of competitive value this is not a feature.

The present value of $10,000,000 per year profit, over twenty years, discounted at 8 per cent, would be $98,-180,000. If the earning and payment of profits should be deferred for three years, and 5 per cent interest be charged during that time (since the sinking fund would be operative until profits were being made), the present value of the profits would amount roughly to $84,500,000. In addition, there would exist a further present value of about $30,000,000 made up of the profits on the present plant from twenty to twenty-five years hence, and on those of the reserve deposit from twenty-three to twenty-eight years hence. This, however, I will disregard so as not to complicate the comparison further.

The present value of $84,500,000 in the reserve is actually available if we assume that the market would stand the additional production; and though good reason may exist for not adding such extra production at present, it would be possible at any time to proceed with it. It exists as a competitive feature which the shareholders cannot afford to disregard.

New York. HUNTINGTON ADAMS.

THE EDITOR:

Sir—I find in reading Huntington Adams' very interesting observations on my discussion of the comparative earning power of North and South American copper producers, that he has placed his finger on a very stupid blunder of mine, that I can account for only by my failure to read over my letter of Oct. 18 before sending it. I have reconstructed the tables below, as I believe they should appear.

1923

	North American Group—Production, Pounds	North American Group—Book Value of Total Assets Jan. 1, 1924
Utah	195,142,919	$71,839,958
Nevada	61,573,246	(a) 14,575,160
Miami	64,611,645	8,048,021
Total	321,327,810	(b) $94,463,139

(a) One-half only, balance owned by Utah.
(b) 2.94c. per lb. of annual capacity

	South American Group—Production Pounds	South American Group—Book Value of Total Assets Jan. 1, 1924
Cerro de Pasco	92,176,000	$50,253,582
Braden	139,500,000	47,864,934
Chile	204,897,590	156,980,261
Total	436,673,590	(c) $255,098,777

(c) 58.4c. per lb. of annual capacity

These figures have been stripped, when necessary, of "revaluation surpluses" and "depletion reserves."

Summary	Earnings per Pound Available for Dividends	Capital Cost per Pound at 8 Per Cent (Depletion)	Profit per Pound
North American group	4.7c.	2.4c.	2.3c.
South American group	5.6c.	4.7c.	0.9c.

My error consisted in transferring the figures for the assets per pound of annual capacity, which are 29c. and 58c., respectively, to the column of capital cost per pound at 8 per cent as 2.9c. and 5.8c. Had I chosen a higher rate, as Mr. Adams conservatively suggests, as, say, 10 per cent, the table in my letter of Oct. 18 would have been correct. However, adher-

ing to the 8 per cent rate, I believe the above is now in order. The estimate still leaves the advantage with the North American group.

I am in thorough accord with Mr. Adams' contention that the most accurate *estimate* of the value of any mining investment must depend on its average annual earning power in the light of past history, present conditions, and future prospects. I believe I made that plain in my article of Sept. 20. Still, it must be admitted that published statements of assets, if they are intended to mean anything, must reflect the directors' estimate of their value, for the benefit of the stockholders, and, presumably, be based on their opinion of the average earning power. In support of this view, one might take the case of the Chile Copper Co. The Anaconda Copper Co. purchased 51 per cent of the stock of that company from the owners, and paid $77,000,000, thus clearly indicating that in the Anaconda's opinion the property is worth about $151,000,000. The first published report since the purchase assigns a book value to the property of $156,980,261. Inasmuch as this purchase was made with the cash proceeds of a sale of Anaconda bonds, so far as Anaconda stockholders at least are concerned, the Chile Copper Co., as is, represents a cash investment of $151,000,000, and before they can receive any real profit therefrom, must make earnings sufficient to justify this figure. On the volume necessary to justify, there will be ample room for the exercise of intelligent judgment.

If Mr. Adams' figure of $42,353,250 is correct as the amount spent in purchasing and equipping the property, and paid for from the proceeds of the sale of Chile Copper Co. bonds, it seems to me that there must be some additions to be made, before we arrive at the capital expenditures made to bring the property up to its capacity and efficiency as of Jan. 1, 1924. Up to that time the property had produced approximately 720,000,000 lb. of copper (1915-1923 inclusive), and received therefrom not less than 18c., or $130,000,000. Whatever profits were made, less distributions to stockholders, bond retirement and net current assets, went back into the property. These various amounts would appear to be $10,908,800, $15,000,000, and $26,014,315, respectively, totaling $51,923,115, leaving about $78,000,000 to pay the cost of production and profit. During this same period that amount of copper produced by the Utah Copper Co. produced approximately $55,000,000 in dividends to the stockholders. If Chile did one-half as well, approximately $28,000,000 of profits must have been put back into the property. On this assumption, the showing made would now be as given in the following table:

Original purchase equipment and working capital	$50,000,000
Profits up to Jan. 1, 1924, reinvested in the property	28,000,000
	$78,000,000
Cash paid by Anaconda for 51 per cent of stock	77,000,000
	$155,000,000

Which brings us again to the same figures cited above.

It is difficult to determine now how much cash has been spent in bringing the Utah Copper Co.'s property up to its present capacity, but, at all events, the original amount for purchase of property and equipment was only about $16,000,000, and the balance now represented on that company's balance sheet by, say, $56,000,000 was paid for out of operating profits in addition to distributing $125,317,827 to the stockholders in dividends.

I believe that this amply supports my claim that the investment necessary to establish a production in the one case has been about twice the investment necessary in the other.

Space limitations will not permit me to discuss any of Mr. Adams' other observations, with which I find myself in substantial agreement. ARTHUR NOTMAN.

New York.

Magma

THE EDITOR:

Sir—As "Magma" has been playing a leading part in discussions of the origin of ore deposits, it seems desirable that there be a clear understanding of just what a magma is. A definition that will satisfy all the uses of the word may be stated as follows: A magma is a more or less fluid rock mass, leavened, saturated, or supersaturated with gases and steam of volcanic origin. As the gases and steam are the whole cause of mobility and the carriers of the minerals of the magma, when the rock mass has lost these gases it is dead and devoid of movement and has ceased to be a magma.

The main point of interest is to indicate as near as may be the origin of the volcanic gases, steam, and heat, which are the sole cause of movement and which quicken the rock mass and thereby give it all the distinguishing features of a magma. The rock part of the magma is a local fusion of material along the path of the volcanic gases and is purely fortuitous and may be anything from granite to basalt or a sedimentary rock.

Obviously, these gases cannot be of surface origin, as they are under tremendous pressure at temperatures above the fusing point of the magmas and are of a composition that in no particular resembles that of the earth's atmosphere. Besides steam, which constitutes from 75 to 95 per cent, they include chlorine, which is probably the chief collector of the minerals, SO_2 and some hydrocarbons. The hydrocarbons are probably the source of the carbonaceous matter in mineral veins, and in case their escape to the surface is stopped by impervious shale beds they may condense to petroleum.

Great beds of volcanic ash are to be found between beds of sedimentary rocks in many places where no other evidences of volcanic action exist. These are the evidences of the explosive magmas which were supersaturated with volcanic steam and gases to such an extent that they tore holes through to the surface and belched forth not only the gases but the rock masses along with them. This volcanic ash or pumice is so expanded by gases that the vacuoles cause it to be lighter than water, and it will float long distances until the vacuoles fill with water, and then it sinks, which explains why it is found between beds of sedimentary rock remote from the source of its exit from the interior of the earth.

Magmas are of all grades of mobility, from the explosive type above mentioned down to the smallest intrusive dike or sill that may not be thicker than a sheet of paper at its farthest penetration into the overlying rocks.

Lava which is erupted from volcanoes is elevated through to the surface by the expansion of the contained gases in just the same manner and on exactly the same principle as water or any other liquid may be pumped

up by an air lift. The active principle is reduction of density; and this same principle is at the base of the isostatic balance, in which all parts of the earth's crust are held with changing conditions of accumulation and escape of magmas under its various parts.

As stated in the definition of magmas, their sole cause is the contained gases; and therefore the isostatic balance of the earth's crust depends upon local and regional accumulations of these gases contained in magmas of great and varying extent. The segregation of these larger, or subcontinental, magmas in their higher parts results in local accumulations of supersaturated magmatic offshoots, which actuate volcanoes and hot springs, form ore deposits, possibly veindikes, earthquakes, and a long list of phenomena including metamorphosis, regional and local.

It must not be forgotten, however, that it is the contained gases that are the carriers of the heat from the barysphere, or more properly the zone of critical temperature, upward to supply the magmas, which are constantly losing gases through volcanoes and other vents to the surface. If it were not for the uninterrupted supply from the zone of critical temperature (in which all matter is potentially gaseous and gravitationally compressed denser than the solids that would form out of it, and in which is held by diffusion a large store of each of the gases that has existed in the earth from its earliest beginning), then there would cease to be any more active volcanoes. In process of geological time the subcontinental magmas would lose the gases which determine the isostatic balance of the earth's surface, and then continental subsidence would follow. The ocean would reign supreme over the whole face of the earth and land would no longer be visible as continents.

Lest it be thought that I am a bear on real estate values, I hasten to remark that this sour note is a remote possibility. The zone of critical temperature is some thousands of miles in diameter, and in it the gases of low critical temperature are held in diffusion until liberated by secular cooling. This is the reason why they have lasted so long. The creep of magmas toward the center of domes and axes of accumulation of mountain ranges carries the overlying crust against itself from opposite sides and causes the folding and overthrust found in mountain ranges and isolated domes like the Black Hills in South Dakota. This creep of magmas, or matter of reduced density, is due to the lighter material seeking the highest point it can reach and is a result of gravitation. As a consequence of this concentration of magmas toward the axes of mountain ranges, the elevations are accentuated and depressions further depressed. This is illustrated by the deep ocean basins in the Pacific which are now known to exist off the west coast of South America and the east coast of Japan.

Elevation starts erosion; and it follows that the impervious covering of sedimentary rocks is removed from mountains and domes and the escape of the leavening gases facilitated. The regional density increases as a result, and subsidence follows; so that we find after each period of elevation and erosion a period of subsidence, resulting in new sedimentary rocks with an unconformity between. The great "Batholith of Central Idaho" which is illustrated on page 535 of *Mining Journal-Press* of Oct. 4 is an example of the foregoing principles.

HIRAM W. HIXON.

Florence, Italy.

Consultation

Latest Metallurgical Practice in Treating Cinnabar Ores

"I would like to get all the detail information possible concerning the latest methods of treating cinnabar, the best kind of a furnace to use, the best method of condensing the vapor, and the condensor that has given the best result. Also, can you give me an idea of what is the lowest grade of ore that can be handled in the best furnace in use at present? If you can refer me to some literature upon the subject it would be much appreciated."

We infer that information is desired in regard to the treatment of a moderate- or low-grade cinnabar ore, rather than the treatment of the mineral cinnabar itself. A large percentage of the quicksilver which has been produced from cinnabar ore in this country has been obtained by the use of the Scott furnace. In the last few years, however, a good deal of attention has been given in California to the application of the rotary furnace of the cement-kiln type, and the largest present producer in the state, the New Idria Quicksilver Mining Co., uses these rotary kilns exclusively. This type of equipment appears to be particularly suitable for relatively large installations, the daily mine output of which amounts to one hundred tons or more, or under the circumstances where power and the necessary mechanical attention are available. The Scott furnace has the advantage of requiring no power, having practically no moving parts, and showing good fuel efficiency in units as small as ten to twenty tons' capacity in twenty-four hours. This furnace is consequently regarded as most suitable for small mines that are situated in regions remote from transportation and other facilities.

According to Duschak, work which has been carried on by the U. S. Bureau of Mines in co-operation with various quicksilver producers has shown that efficient and inexpensive condensers can be constructed of ordinary glazed sewer tile. Wooden tanks are sometimes used as settling chambers in conjunction with the tile. In the past, massive brick and stone chambers have been used for condensation, but this practice has been largely abandoned.

It is difficult to make any definite statement in regard to the lowest grade of ore than can be treated, as this varies considerably with local conditions and particularly with the price of quicksilver. In the last few years several plants have operated successfully with ore running as low as six to eight pounds of mercury per ton.

According to the statistics of the U. S. Geological Survey, the total quantity of quicksilver ore reported as treated in furnaces during 1923 was 50,771 tons and this yielded 7,695 flasks of quicksilver—a rate of 0.57 per cent, or 11.4 lb. per ton of ore. In 1922 the average yield of furnace ore was 0.48 per cent or 9.6 lb. per ton of ore.

The most comprehensive discussion of quicksilver metallurgy which is now available is found in Bulletin No. 78, of the California State Mining Bureau (Ferry Building, San Francisco), "Quicksilver Resources of California," by W. W. Bradley. L. H. Duschak, of the U. S. Bureau of Mines, at present is preparing a report on quicksilver metallurgy which will probably be completed and ready for distribution in the course of a few months.

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

THE ANACONDA COPPER MINING CO. will increase the capacity of its zinc plant at Great Falls, Mont., thereby improving its position in the zinc-mining industry of the Northwest. It will make a strong bid for zinc concentrate from the Star mine, in the Coeur d'Alene district of Idaho.

Shipments of iron ore from the Lake Superior region in 1924 totaled 43,000,000 tons; but estimates for next year are as high as 65,000,000 tons.

Purchase of property in the Baxter Springs section, through its subsidiary, the Peru Mining Co., marks the entrance of the Illinois Zinc Co. in the mining business.

Production of gold in Ontario for nine months in 1924 was $36,000,000, against $31,000,000 in 1923.

The Combined Metals Reduction Co. has put in operation its lead leaching plant at Bauer, Utah.

With shipments of concentrate totaling 55,739 tons to date in 1924, the Federal M. & S. Co. assumes first place as a producer in the Joplin-Miami district.

The Tonopah Extension Mining Co. has exchanged shares valued at about $250,000 for twenty-one patented claims belonging to the Tonopah Mines Corporation.

After producing about $75,000,000, mining at the Hercules mine at Mullen, Idaho, has been discontinued permanently.

Consumers of non-ferrous metals have approached government officials regarding the making of a survey of world resources of lead, zinc, tin, and copper.

The Trout Mining Co. is building a manganese concentrator at Philipsburg, Mont. Two other properties in the district are shipping regularly.

Strike at Helca Adds Much to Lead Ore Reserves

Cutting of Oreshoot in New 400-Ft. Shaft Is Significant—Sinking Will Proceed

The recent strike at the Hecla mine, in the Coeur d'Alene district, Idaho, adds millions in value to the known ore reserves and assures the future production of the mine for many years. The present deepest productive level of the Hecla mine is the 2,000, although this is about 3,500 ft. below the apex of the vein. On this deep level the oreshoot is 1,800 ft. long. Preparatory to the development of this shoot at further depth, a shaft has been sunk near it and well toward its east end. This shaft has now attained a depth of 400 ft. and from the bottom a crosscut has been run to the vein. It was here that the strike was made. The shoot is practically a duplicate of that on the 2,000, and all geological conditions are identical.

Drifts will be run further to investigate the orebody, following which the shaft will be sunk another 400 ft., where the vein will again be crosscut. If conditions are found satisfactory at that new depth, then the main shaft, which is quite a distance from the oreshoot, will be sunk 800 ft. and new levels opened at 2,400 and 2,800 ft., the present depth of the shaft being 2,000. The uniformity with which the Hecla oreshoot has persisted to the present operating level, and the finding of the ore unimpaired 400 ft. below it, combine to give reasonable assurance that it will be found in essential respects the same at much greater depth.

Federal M. & S. Co. Leads Shippers in Joplin-Miami Field

THE Federal Mining & Smelting Co. has broken all records for zinc-ore shipments from the Joplin-Miami field for one year. It recently brought its total shipments for 1924 to 55,739 tons, and the best previous record was held by the Commerce Mining & Royalty Co., 54,415 tons, made in 1923. In 1923 the Federal shipped only 25,000 tons, and its enlarged shipments this year are due to the purchase, last spring, of the Moses-Childress interests.

It is considered likely that the Commerce Mining & Royalty Co., which has been holding down activities a great part of the year, may yet send its total shipments for the year to at least as high as the new record established by the Federal, and perhaps surpass it. At present it has shipped just a little less than 50,000 tons.

Iron-ore Shipments Totaled 43,000,000 During 1924 Season

Better Outlook for 1925—Expected that 65,000,000-Ton Mark Will Be Approached

The iron ore mines of the Lake Superior district shipped a total of 42,623,572 tons by water during the season just closed. This compares with 59,036,704 tons sent out in that manner in 1923. The tonnage this year was close to the estimates made when navigation opened on the Lakes last spring.

The shipments by ports for Lake Superior and Lake Michigan were:

Duluth	12,882,082
Two Harbors	4,817,494
Superior	13,355,214
Ashland	4,807,565
Escanaba	4,244,669
Marquette	2,516,548
Total	42,623,572

To the Lake shipments must be added about 1,000,000 tons sent all-rail to the furnaces. Most of the all-rail ore goes to charcoal-iron furnaces in the Lake Superior region and to the plant of the Minnesota Steel Co.

The largest amount ever shipped from the mines in Lake Superior was in 1916, when the total reached 66,658,466 tons. It is thought that the movement in 1925 will be approximately 65,000,000 tons and that the ore prices which are to prevail throughout the year will be set early in 1925.

More Golf and Swims for Inspiration Employees

THE Inspiration Consolidated Copper Co. is to construct a new nine-hole golf course and clubhouse for the Cobre Valley Country Club on land lying to the east of the present course. The company has found it necessary to add to its tailing dump ground the land now being devoted to the Scotch pastime.

Dr. L. D. Ricketts, president of the company, will personally finance the construction of a swimming pool for the club which will adjoin the new clubhouse. The Inspiration company is the owner of the land where both the old and the proposed new courses lie.

New Manganese Concentrator at Philipsburg, Mont., Progresses

Manganese mining in the Philipsburg district, in Montana, is fairly active. The Trout Mining Co. is building a concentrating plant and plans to have it operating early in January. The Northern Pacific is building a spur to this plant at the present time. It is planned to ship from 30 to 50 tons of high-grade manganese concentrates from this mill daily. The products are to be shipped direct to battery manufacturers. Lester Frink, formerly connected with the management of the North Butte Mining Co. at Butte, is general manager of this property. It is said that about forty men will be employed when the plant is in operation.

The Philipsburg Mining Co. is shipping about three cars of high-grade manganese per day. The Hickey plant is also producing steadily, but not on so large a scale.

Bully Hill Operation

The Bully Hill mine and zinc oxide plant at Winthrop, Calif., formerly under the control of the Shasta Zinc & Copper Co., is now being operated by Adrian D. Joyce, of Cleveland, Ohio, and not under the name of the California Zinc Co., which has been erroneously applied to Mr. Joyce's operations on the Bully Hill property.

On the Average Joplin-Miami Producers Lose Money!

Figures compiled by the Tri-State Zinc and Lead Producers' Association indicate that the average cost of producing a ton of zinc concentrate in the Tri-State district in the first eight months of 1924 was $42.14. An actual operating cost of $28.63 is shown, including labor and supplies. Depletion and royalty costs make up the rest.

The average selling price of ore has been below $41 a ton, so far this year, which indicates a loss to the mine operators. It is estimated with zinc ore selling at $50 a ton the average profit would not be above $6 a ton, as costs increase, particularly labor costs, with ascending ore prices.

Combined Metals Reduction Co. Starts New Leaching Plant in Utah

Hydrometallurgical Section Just Completed—Will Treat Zinc-Lead-Silver Ore from Pioche—In Market for Custom Ore

THE new flotation and lead-leaching plants of the Combined Metals Reduction Co., at the mouth of the Honorine tunnel, at Bauer, near Stockton, Utah, are an interesting addition to metallurgical operations of the state. These plants, built primarily to treat ores from the Pioche district in Nevada, at the initiative of Utah men, with the support of the National Lead Co., will also take custom ores.

The first of the plants, completed last May, is a selective flotation mill with a capacity of 200 tons daily, and with space provided for doubling this tonnage. The hydrometallurgical plant for the recovery of lead has just been completed and started. It is original in design and method. The crushing unit of the flotation mill will have a capacity of 1,000 tons per day.

After being crushed to ¼-in. size, the ore is stacked in large bins, from which it is fed by a belt conveyor into a ball mill for grinding to 200 mesh. The ore passes through an Akins classifier into a large settling tank, from which it goes into the flotation circuit. Fagergren flotation machines are used. The products are lead-iron concentrates and a high-grade zinc concentrate. The tailings are impounded for further treatment in the leaching plant, if desired.

Ore not amenable to flotation, as well as unroasted concentrates, can be treated in the new lead-leaching plant as under the process in use; the roasting usually necessary before leaching can be undertaken is not required. The ultimate capacity of the leaching plant is to be 500 tons. Two units of 100-ton capacity each are now in operation. One of these will treat concentrates from the flotation mill, and the other will treat custom ores.

The lead and silver are recovered separately in the leaching plant, and the lead precipitates will be refined at Bauer. The new hydrometallurgical plant will treat refractory ores. The location of the mills at Bauer is favorable to the enterprise, as both sulphur and salt can be obtained in the neighborhood. The company's mine at Pioche has a good body of ore on the 550 level, and is shipping 200 tons daily to the mill at Bauer, the tonnage at present required. Some high-grade ore has been opened on the 650 level. This is being sacked daily for shipment direct to the smelter. E. H. Snyder is manager for the Combined Metals Company.

Leadville Mines Co. Plans Steady Winter Operation

The inside shaft of the Leadville Mines Co., operating a lead-silver mine at Leadville, Nev., has been completed to the 700 level and a station and pockets are being cut preparatory to crosscutting to the vein, an estimated distance of 60 to 70 ft.

The management reports that there is sufficient ore in sight immediately above the 600 level to operate the mill for at least two months. At the end of that time development on the 700 should be in such condition that normal production can be maintained from that level. As soon as work has progressed sufficiently on the 700 the shaft is to be sunk to the 800 level.

Operating conditions and production are normal, and the concentrating plant is treating 50 to 60 tons of ore per day, which will average about 30 oz. silver and 5 per cent lead. Preparations are complete for winter work, and operation of both mine and mill should be fairly continuous through the winter months.

Butte & Midwest to Enlarge Mill in Montana

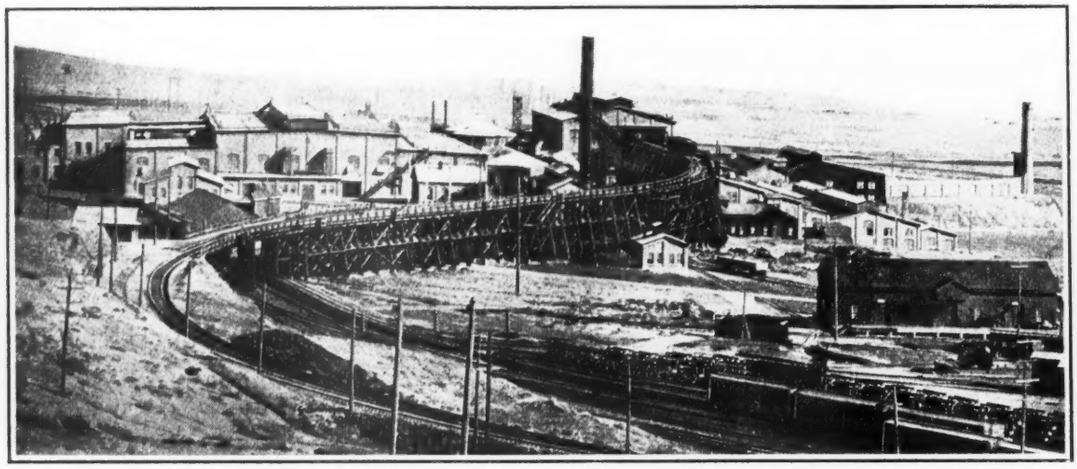
The Butte & Midwest Mining Co., whose property is situated at Jens, Mont., has finished mill tests and is planning to enlarge its mill to treat 75 tons per day. Machinery has been ordered and construction work will continue during the winter months if weather conditions permit.

Two New Concentrators for Century Zinc Co.

The Century Zinc Co. has been organized to take over the development work of the Smith-Davis and Vinegar Hill Zinc companies, in the Joplin-Miami field. The Century Zinc Co. thus comes into possession of leases on 520 acres of promising mineral land, and will have two new mills in operation during the coming year. One of these, now under construction, is just south of Baxter Springs, adjacent to the old Diamond Joe property, which the company also controls. The second mill, construction on which is to be started soon, will be placed on the 80-acre Blue Mound lease.

Court Fails to Ratify Sale of Iron Mask Mine

Justice D. A. McDonald, in the Supreme Court of British Columbia, has refused to ratify the sale of the Kamloops Copper Co.'s assets, which include the Iron Mask mine and plant, near Kamloops, and which recently was purchased at a sale for $17,500, and has fixed the selling price at $40,000. H. F. Sigel, one of the defunct company's bond holders, who bought the mine at the sale, will be given the option of purchasing it at the advanced price. The sale was protested by the Royal Bank of Canada, which was a creditor to the extent of $13,500, for money advanced to the receiver to conserve the property.



Anaconda's electrolytic zinc plant at Great Falls, Mont.
Virtually all of the zinc concentrate produced in Utah, Idaho, and Montana is now treated here. The capacity is now being increased.

Anaconda Strengthens Position in Western Zinc Industry

Arranges to Concentrate Utah Complex Ores on Custom Basis—Gets Surplus from Trail—Will Make Strong Bid for Star Zinc Concentrate in Coeur d'Alene

By A. B. Parsons
Assistant Editor

RECENT DEVELOPMENTS in the Northwest have strengthened the position of the Anaconda Copper Mining Co. in the zinc-producing industry of that region. Anaconda holds a dominant position by virtue of its large leaching plant and electrolytic refinery at Great Falls, Mont., from which 140,363,000 lb. of zinc was produced in 1923. This plant now has a capacity of about 14,000,000 lb. of finished zinc per month, but work has just been started whereby this will be increased by 20 per cent or more. This will be accomplished by improving the efficiency of the process rather than by enlarging the plant. About $350,000 will be expended in the work.

At present Anaconda gets virtually all of the zinc produced in Montana and Idaho. Besides the mines it operates at Butte, including the Emma, Nettie, Anselmo; and Orphan Girl, the Butte & Superior Co.'s Black Rock mine ships its ore to the Washoe Reduction Works for concentration, preparatory to treatment at Great Falls; and the output of Senator Clark's Timber Butte mill goes direct to Great Falls. The Federal Mining & Smelting Co. consigns the zinc concentrate from its Morning mill at Mullan, Idaho, to the same plant, as does the Success, and one or two smaller properties in the Coeur d'Alene district, when they are operating.

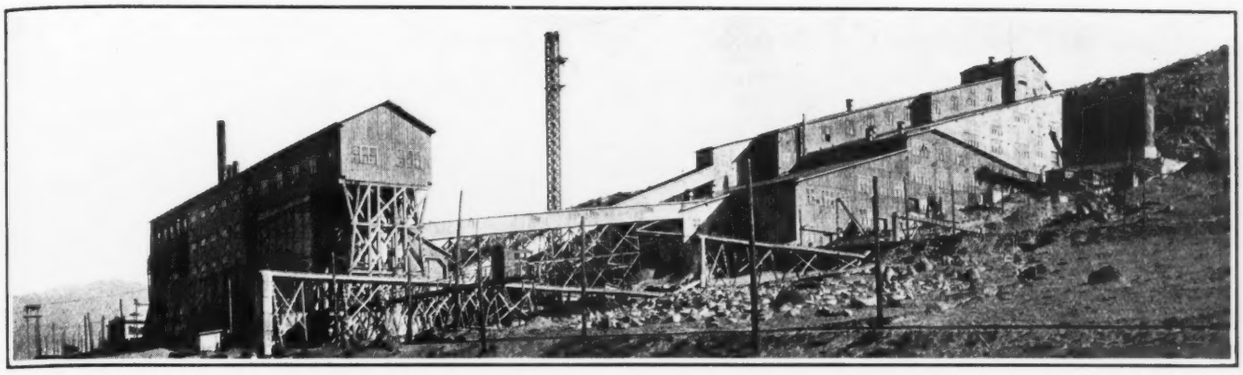
The demands of Anaconda's subsidiary, the American Brass Co., for zinc to make its principal alloy, together with the requirements for fabricated zinc products and zinc oxide that other subsidiaries turn out, afford an outlet for a huge quantity of zinc. But aside from that, it is important that Anaconda look to the future to provide a supply of raw material to keep its Great Falls plant supplied; and, in addition, to forestall, if possible, the erection of competing plants, particularly that projected by the Bunker Hill & Sullivan company at Kellogg, Idaho.

In this connection Frank M. Smith, smelter director of the Bunker Hill company, recently said that the construction of a zinc plant by his company "might not be attractive." The statement was made in commenting on the character of the ore opened a few weeks ago in drifting on the oreshoot on the deep-crosscut level of the Star mine, owned jointly by the Hecla and Bunker Hill companies. The proportion of lead as compared to zinc is appreciably greater than had been expected. Moreover, it is said that the admixture of the lead and zinc minerals is not as intimate as was the case in the upper levels of the mine.

The Bunker Hill company, under the guidance of U. C. Tainton, has developed a process whereby this Star concentrate, according to present plans, is to be treated by hydrometallurgical methods, first for zinc and then for lead. If, however, it is found that a zinc concentrate fairly free of lead can be made by flotation, it may not, as Mr. Smith says, be "attractive" to proceed with the erection of a costly zinc plant. The determining factor doubtless will be the terms that Anaconda will make on the treatment of the zinc concentrate. It is safe to say that it will stretch the point as far as it can, not only to get the Star concentrate, but to prevent the creation of a near-by market for other zinc producers in the Coeur d'Alene and tributary country. There are said to be large potential zinc orebodies, especially in the Pine Creek section.

Another recent change is the diversion of shipments of excess zinc concentrate by the Consolidated Mining & Smelting Co. of Canada from Belgium to Great Falls. The Consolidated company's zinc plant at Trail is unable to handle the products from the Sullivan concentrator in addition to sundry cus-

Old Utah "Con" copper concentrator
The International Smelting Co., Anaconda subsidiary, which acquired this plant a year ago, has remodeled it to treat Park City zinc-lead ore.



The Timber Butte concentrator at Butte, Mont.

Zinc ore from Senator Clark's Elm Orlu Mine is floated here, the concentrate being shipped to Anaconda's Great Falls plant

om shipments from smaller mines in British Columbia. Shipments of the surplus have been going to Belgium, but these have stopped and 600 tons has already been delivered to Great Falls. This may or may not be significant. At any rate, a channel has been opened and the flow might be increased. The Sullivan concentrator has a capacity of only about 3,000 tons a day, and it has been reported that enlargement to 6,000 has been planned. The mine is believed to have more than ample reserves to warrant such an increase. If the output of concentrate is increased either the Trail electrolytic zinc plant will have to be enlarged or the concentrate will have to be sold to the highest bidder. But that is looking into the future a year or two at least.

Anaconda is reaching out in still another direction for zinc—to Utah. About a year ago Anaconda engineers and geologists made a thorough survey of mines in the Park City and other districts in Utah with a view to ascertaining the potential supply of "complex" lead-zinc ore. It was thought at the time that a modern concentrator might be built at Park City, but that did not materialize. Nevertheless, the results apparently were satisfactory. The International Smelting Co., another subsidiary of Anaconda, has just finished remodeling one unit of the old Utah Consolidated copper concentrator to treat ore of this class. The plant, which is adjacent to the International smelter, at Tooele, was acquired last spring, and it is now equipped to make a close separation by preferential flotation on lead-zinc ores. Latest reports are to the effect that a second unit is being converted so as to give a daily capacity of 1,300 tons of ore. Ore will be bought on a custom basis and will be treated to produce a lead concentrate that will be smelted at the Tooele plant of the International company; and a zinc concentrate, with a reasonably low lead content, to ship to Great Falls.

A feature of the remodeled concentrator is a flexibility which is expected to make it practicable to adjust the reagents or the flow sheet if necessary, to meet the requirements of a variety of ores. At the start, however, virtually all of the ore will come from the mines of the Park City Mining & Smelting Co.

The changes at Great Falls are understood to be along the lines developed by Tainton at Martinez, Calif., and at Kellogg, Idaho. "High-acid" leaching will both increase the capacity of the present equipment materially, and improve the extraction of zinc. Instead of assaying 13 per cent zinc, the residue is expected to average about 6 or 7 per cent. Besides increasing the recovery this will make a more desirable lead residue for treatment in the Helena smelter to which it is shipped from Great Falls.

Just at present the Anaconda company is more concerned with sources of zinc ore than of copper. However, the mountains of Montana, Idaho, Utah and British Columbia are supposed to contain huge reserves of lead-zinc ores waiting only for successful metallurgy to make them profitable. Various interests are engaged on this problem. A hydrometallurgical plant financed by the National Lead Co. for treating ores of this type has just been completed at Bauer, Utah. However, Anaconda, no doubt, will get its share.

Bingo Shares Fall With a Bang!

By Our Special Correspondent in Toronto

A CABLE DISPATCH has just been received from London giving particulars of the statement issued by the directors of the Bingo Mines, of the Herb Lake district of northern Manitoba. The statement says that recent sampling having failed to confirm the previous reported values, the company has engaged John A. Dresser, of Montreal, past president of the Canadian Institute of Mining & Metallurgy, to make a complete examination and valuation of the mine. Following the announcement, Bingo shares fell rapidly, and persistent selling indicates that the unfavorable developments were known in advance of official information.

Attention was drawn to this matter in *Mining Journal-Press* some weeks ago, in which news letter it was stated that many unsupported reports regarding high values over extreme width made a complete report by an independent engineer desirable.

See End of Hollinger-Northern Canada Power Dispute

Nesbitt, Thomson & Co., of Montreal, a bond house specializing in the sale of hydro-electric securities, has issued a circular to Northern Canada Power Co. shareholders offering $40 a share for their stock. This is the price at which the directors, who own a large majority of the shares, have agreed to sell. The Northern Canada Power Co., which supplies the Porcupine district, has 60,000 shares, par value $100, in addition to $5,708,000 worth of bonds. It is understood that this is a preliminary move in the taking over of the control of the principal power companies in northern Ontario and will eventually lead to an amicable settlement between the Hollinger and the Northern Canada Power Co. of the dispute which is now in the courts.

Diamond Drill Cuts Ore at Kay Copper Mine

The main orebody in the Kay mine at Canyon, Ariz., has been crossed by a diamond drill at the 1,200 level of the main or No. 4 shaft. The vein at the place intersected appears to be about 75 ft. wide, with 15 ft. of low-grade ore on the footwall side.

The strike was made 120 ft. ahead of the face of the west crosscut and that heading is now being pushed forward as fast as possible. It is expected that this crosscut will reach the orebody in December. The main orebody is now proved to a total vertical depth of 1,200 ft. Small shipments running as high as 13 per cent copper have been made from workings above the 600 level of No. 1 shaft.

Hope to Develop Gilbert Camp by Lease System

Owners of the original discovery at Camp Gilbert, 29 miles westerly from Tonopah, in Nevada, have decided to lease the most promising part of their property. Liberal royalties are allowed, which the owners think will develop their property rapidly and efficiently. The ground is to be divided into blocks 100 ft. long, along the vein strike, and 600 ft. wide. The owners are reserving 100 ft. on each side of their working shaft for company work.

Premier Cuts Rich New Shoot, Is Report in Victoria, B. C.

New York Officials Say "News to Us" —Big Jump in Shares on Western Exchange

In a drift from No. 6 tunnel, the Premier Gold Mining Co. in British Columbia, according to reports current in Victoria, has struck the downward extension of one of the pay-shoots that proved so profitable in the upper workings. The value of the ore found on No. 6 level averages around $45 per ton, whereas in No. 4 level, 500 ft. above, it averages around $13, which the advocates of the theory that the rich ore in the upper workings was due to secondary enrichment may find a little puzzling. Though no official announcement of the strike has been made, the quotations for the company's shares, which for some time have been low, considering the steady dividends that have been disbursed, took a sudden jump in the local exchanges and now are being quoted at nearly double what they were a few days ago. So far, nothing but development has been done below No. 4 level, as a considerable block of ore between No. 3 and No. 4 levels still remains to be stoped. No. 6 is a double-track tunnel, and presumably has been driven as a main-haulage tunnel. Rumor has it that a new milling plant will be constructed at the portal, in the near future. The latest strike, which gives 500 ft. of virgin ground between No. 6 and No. 4 levels and an undetermined depth below No. 6, will add several years to the life of the mine.

Inquiry at the New York office of the American Smelting & Refining Co., of which the Premier is a subsidiary, elicits the information that no reports of an important strike have reached officials here.

In some quarters it is intimated that certain Canadian shareholders may possibly be "bulling" the stock, and that they are responsible for the reports.

New Find Renews Interest West of Joplin

Renewed interest in the northwestern section of the Joplin-Miami district has been brought about by reports of an excellent drill strike made by Miami parties on a lease about three miles north and slightly east of the Lucky Jew mine, now being operated by the Eagle-Picher Lead Co.

Attention was called to this part of the field some months ago, when the Lawyers' Mining Co. reported a good drill hole on a tract north of the Lucky Jew. Leases in the territory were immediately in demand, and several different companies began drilling operations. Results, however, for a long time were discouraging, one company reporting it had spent $25,000 with nothing but a few "shines" to show for it. The latest descovery, however, revives interest, and several of the companies that had planned abandonment of the tract will continue their work pending further developments.

Mine Production in Parral, Mexico, Increases Measurably

Government Agent Sees Greater Activity—New Plants—Shortage of Railway Cars

Juan Vela, an industrial agent of Mexico, recently submitted to the Secretary of Industry and Commerce a favorable report on mining in the Parral and near-by districts. The metal production during the first quarter of this year showed an increase of 50 per cent over that of the last quarter of the previous year. The installation of modern machinery, construction of additional reduction plants and development of the mines continues to increase the output.

The American Smelting & Refining Co., controlling the Villa Escobedo, Santa Barbara, La Palmilla, and Parral mines, now has six plants in operation, including flotation, concentrating, and cyaniding. This company has also taken over La Prieta mine, in La Cruz mountain, adjoining the City of Parral, and will erect a mill for treating the ores on the ground.

The British corporation known as the San Francisco Mines of Mexico, Ltd., is operating at San Francisco del Oro near Santa Barbara. It has a flotation plant of large capacity, requiring two trains daily to transport the output from the mill and mines over the Parral & Durango railroad to Parral, where it connects with the National Railways. The output of this company during 1923 was double that of the previous year and 1924 will show an increase over 1923.

The Caiman Mining Co., Iguana Mining Co., Orion Esmeralda Mining Co., and the San Nicolas are planning active operations. At present some shippers are unable to obtain sufficient cars for transporting ores promptly.

The San Patricio mines, under the management of T. A. MacKenzie, are yielding well and production is gradually increasing. This property, as well as many others of the Parral district, obtains its power from the electric power plant of the Cia. Agricola y Fuerza Electrica de la Boquilla y Rio Conchos.

The Tecolotes, Santa Rosalia, Cigarrero, Guadalupe y Calvo, Juliette, and other mines under American management are working steadily and producing a good tonnage.

Minnesota Will Establish New Mine Safety Code

Governor Preus of Minnesota has received the report of the committee appointed to investigate the Milford mine disaster on the Cuyuna range, when forty-two miners lost their lives through the flooding of the mine. Though no recommendations for a safety code accompanied the report, this will be sent later as soon as a code is formulated. The committee appointed to make up this code consists of A. A. Krogdahl, of the Oliver Iron Mining Co.; G. H. Lohneis, of the Republic Iron & Steel Co.; R. L. Wahl, of the Inland Steel Co.; George Martinson, of Pickands, Mather & Co., and John Turk of the Shenango Furnace Co.

Hercules, Worked Out, Ceases Production in Idaho

Output About $75,000,000 — Company Will Do Extensive Development Work—Has Several Prospects

As anticipated in a recent issue of *Mining Journal-Press*, the Hercules mine, in the Coeur d'Alene district, Idaho, has closed down owing to the exhaustion of its great lead-silver orebodies. For the last few months the operating force has been steadily reduced, and when the end came only a remnant was left to take out the pillars of ore and consign the famous bonanza to the ultimate fate of all mines.

The Hercules paid its first dividend in 1901 and is credited with paying more than $18,000,000 to its fortunate owners. The gross value of ore produced by the Hercules is estimated at more than $75,000,000.

But the abandonment of the Hercules mine does not mean the end of the active career of the Hercules Mining Co. That company is engaged in much development work on other properties which it owns or controls. From the Hercules workings north a crosscut is being run to the Honolulu. Across the canyon another deep crosscut is being run to explore the Maher-Hearn, lying east of the Hecla. At the Western Union arrangements are about complete to commence extensive development.

In addition there is the Ambergris, joining the Hercules on the north, controlled by the Hercules and in which extensive orebodies have been developed from the Hercules workings. Just below is the Sherman, another property controlled by the Hercules, in which considerable ore has been developed in what is believed to be the extension of the Tamarack vein. With all these properties and other undeveloped ground to draw upon, it may reasonably be expected that the Hercules Mining Co. will again take its place among the important producers of the Coeur d'Alene district.

Illinois Zinc Co. Enters Mining "Game" in Kansas

The Illinois Zinc Co. began a new era in its operations in the Joplin-Miami field when it completed this week, through the Peru Mining Co., its subsidiary, the purchase of the Queen Esther Mining Co.'s property, including mine and mill, with about 100 acres of other mineralized leases in the Kansas section of the field, southwest of Baxter Springs.

Heretofore the Illinois Zinc Co., which started zinc smelting in Peru, Ind., in 1870, has restricted its activities to smelting and zinc rolling. For many years it has had an office in Joplin with a resident buyer, and has been one of the most consistent purchasers of high-grade, lead-free ores. This will be its initial venture in mining.

C. H. Durfee, who has been agent for the Illinois Zinc Co. for the last year, will be general manager of the Peru Mining Co., while retaining his position as district agent for the company in the State of Illinois.

News from Washington

By PAUL WOOTON
Special Correspondent

Consumers Seek World Survey of Non-Ferrous Metal Resources

Electrical Manufacturer Inquires About Copper—Lead Gives Most Concern—Is Survey a Legitimate Government Function?

INCREASING concern is evidenced as to future supplies of the major non-ferrous metals. The consuming industries, in particular, are anxious that the Federal Government undertake the gathering of data which will permit more accurate estimates of the world reserve of lead, tin, copper and zinc.

It is admitted by the government's non-ferrous specialists that existing figures as to world reserves of these metals are little more than guesses. In fact, we have none too abundant information as to unmined domestic deposits.

One of the large concerns engaged in the manufacture of electrical equipment, prompted by the upturn in copper prices, has inquired if an inquiry of this sort does not come within the province of the Federal Government. It is pointed out that this is a type of survey which cannot be undertaken by private industry. Though it is admitted that information upon this subject would be valuable to consumers of copper and other non-ferrous metals, the public generally would be benefited sufficiently, it was thought, to justify the expenditure of taxpayers' money in such an activity. This inquiry supplements similar suggestions that have come from refining and producing interests. The consensus of opinion seems to be that the government is in a better position to undertake the gathering of such information in foreign countries, although the idea is that substantial co-operation would be furnished by interested trade associations and technical societies.

The information wanted most urgently is in respect to lead. Though the shortage of that metal has long been in evidence, there still is great uncertainty as to the output which may be brought out by the higher level of prices. Spain is known to possess considerable potentialities for lead production, and there is a demand for information at this time as to the price level which will stimulate the development of this Spanish resource. This particular question is being investigated by one of the government agencies. It is believed, however, that there are other sources of lead which the government's far-flung personnel could ferret out, and thus be instrumental in bringing them to the attention of those who might be interested in prospecting them.

The prospects for greatly increased consumption of copper have caused some uneasiness, even in connection with supplies of that metal. It is believed, however, that there is less cause for concern about world resources of that metal than about those of any other one of the metals mentioned.

Tonopah Extension Buys 21 Claims in Virgin Ground

Consideration 85,000 Shares of Stock; Equivalent to $250,000—New Shaft Planned

The Tonopah Extension Mining Co. has purchased the Tonopah Mines Corporation property, in the Tonopah district, adjoining the Tonopah Extension ground on the northwest, for a consideration of 85,000 shares of its stock.

The Tonopah Mines Corporation property is a compact group of 21 patented lode claims, with an area of about 350 acres, lying west of the Victor and Cash Boy shafts of the Tonopah Extension and presumably in line with the strike of the orebodies developed from those shafts. No work of importance has ever been done on the ground, so that it is virgin territory. The purchase price of the group was 85,000 shares of Tonopah Extension stock, which was exchanged on a basis of one for four shares of the 340,000 shares of Tonopah Mines Corporation stock outstanding. At the present market valuation of Tonopah Extension stock this represents a price of about $250,000. It is reported that the new shaft contemplated by the Tonopah Extension will be situated near the southeast corner of this property, about 2,500 ft. west of the Victor shaft.

Tonopah Extension gross production for October was valued at $225,406, with net profit of $83,837. This is about normal for this company in recent months. Net profits for the first ten months were $704,763, which is the largest by far in the history of the company. Production for November will be less, judging by the bullion shipment representing results of the first fifteen days' operations, which amounted to 106,000 oz. bullion valued at $90,000.

M. A. Hanna Co. Reorganizes Iron Mining Operations

The various iron mining operations of the M. A. Hanna Co. in the Lake Superior district have been consolidated with two districts, which are now known as the Mesabi district and the Michigan district, according to Earl E. Hunner, of Duluth, general manager of mines for the company. F. H. Cohoe, of Hibbing, and George M. Cannon, of Iron River, are district superintendents.

Johannesburg Letter

By John Watson
Special Correspondent

Reward of £5,000 Offered for Placer Gold Discovery

Must Supply Work for 300 Diggers for Twelve Months—Southern Rhodesian Government Is Donor

Johannesburg, Nov. 4—The *Government Gazette* of Southern Rhodesia published on Oct. 24 contains a notice offering a reward of £5,000 to the discoverer of a gold alluvial diggings in Southern Rhodesia, on which not less than 300 adult male diggers of European descent shall have been employed, continuously, for a period of not less than twelve months. No claim may be lodged except by a registered claim holder in an alluvial digging and no claim for the reward shall be recognized unless notice of intention to make the claim has been lodged with the mining commissioner of the district within thirty days from the date of discovery. In the gold belt area, near Sinoia, alluvial workings are being conducted on the Angwa River. The small rivers of Rhodesia do not run all the year round. This is the first reward of the kind offered in Rhodesia in regard to gold.

It is recognized that it is a big task to gain the reward; but the other aspect is that prospectors may locate other minerals while searching for alluvial gold.

The spread of the locust plague in the Union has caused a demand for arsenic used as arsenite of soda for spraying. Practically the whole of the South African production comes from Southern Rhodesia. The output of arsenic for 1923 was made up of 852 tons from Southern Rhodesia and only 6 tons from the Union. Following the rise in price of arsenic during the war, the Standard Arsenic, Ltd., was formed and the company pumped the Champion Mine (Odzi district), free of water and worked it for arsenic. White arsenic is produced and a cattle dip is manufactured at the mine.

At the Consort gold mine, near Barberton, the concentrates obtained are said to make the recovery of arsenic a payable possibility. Prior to the war, arsenic sold for £15 per ton; whereas now the price in Europe is about £45 per ton. About a year ago, it rose to £60 to £70 per ton. The greater part of the Southern Rhodesian arsenic is used in South Africa, and the Union, for the first half of 1924 has also imported from overseas arsenical products to the value of about £150,000.

The mineral production of the Union of South Africa, for the first nine months of this year, and last, has been as follows:

	Jan.-Sept. 1923	Jan.-Sept. 1924
Gold (at standard value)	£28,880,195	£30,278,532
Gold premium value, plus	1,293,956	3,249,931
Silver	146,928	155,946
Osmiridium	19,692	58,624
Diamonds	4,135,847	6,025,681
Coal (sales)	2,771,629	2,850,235
Copper ore and concentrates	282,896	365,202
Tin concentrates and metallic	122,354	225,973
Other minerals	220,254	217,150

London Letter

By W. A. Doman
Special Correspondent

Ooregum Has 2-Oz. Gold Assays on 67th Level

Indian Shares Not Hot Favorites—Selukwe Would Sell B. C. Silver Mine to Premier

London, Nov. 25—Indian gold-mining shares are not the favorites they once were. The deepening of the mines increases the costs of working, and dividends have fallen off in recent years. Although investors have followed the four great companies on the Kolar field through alternate zones of enrichment and impoverishment, a certain degree of confidence and pluck is required to buy shares in a property the lowest workings of which are a mile and a quarter below the surface. The old Ooregum is at present showing up well, for in the 67th level values like these are being disclosed: 2 oz. 9 dwt. over a width of 2 ft.; 2 oz. 4 dwt. over 5 ft.; 1 oz. 4 dwt. over 1 ft. 6 in.; 2 oz. 2 dwt. over 2 ft. 3 in. and 2 oz. 3 dwt. over 2 ft. 3 in. Quartz of this kind is useful stuff at such a depth, and if there is much of it the company would be enabled to augment its ore reserves. It is expected that the circular shaft will be available for hoisting within the next few weeks.

The Selukwe company which is interested in a gold-mining property in British Columbia and in a silver-lead mine in the Shan States, in Burma, is again in the limelight. An issue of 50,000 shares has been made privately, and the only intimation given as to the purpose for which the funds are required is to meet the needs for plant of subsidiary companies. It may be in connection with the silver-lead property, but it is generally thought to be connected with the B. C. Silver, the purpose being the creation of a strong financial position for purposes of negotiation with the Premier Gold Mining Co., near whose property the B. C. holdings are situated. The Shan States property, it may be mentioned, is opening up lead ore of 25 and 16 per cent.

It is difficult to keep away from the subject of tin mining in Cornwall; something new always seems to be happening there, and as the number of known lode deposits in the world is not large, and yields are relatively small, it is interesting to learn that at the recent meeting of the Cornish Institute of Mining Engineers the president stated that four tin lodes had been discovered at Bolingey, by residents, and that the content was in no instance less than 40 lb. of tin to the ton.

The Anglo-American Corporation of South Africa has been appointed consulting engineers in Johannesburg to the Bwana M'Kubwa Copper Co. (Rhodesia). This indicates that operations will be on an extensive scale—when the necessary plant is installed.

Questions are being asked as to why Canadian mining shares are not popular on this side. A few months ago various mining engineers and other experts were writing glowing accounts of the prospects of different properties in the Dominion. Latterly there has been quite an absence of news, which is beginning to disturb those investors who hold dollar shares and who fancy they have been misled. The feeling is not unnatural, seeing that quite a young army of adventurers from the other side of the Atlantic have invaded this side, sold oil and mine shares by means of circulars, and then left the country, so that purchasers are nursing the baby and cannot sell because there is no market. The real reason for silence doubtless is that the solid companies are settling down to work.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Ontario Gold Mines Increase Output; Silver Drops

Arsenic from Silver Refineries Totaled 3,654,000 Lb. in Nine Months—Horne Property Looks Good

Toronto, Dec. 7—Returns from the metalliferous mines, smelters and refining works of the Province of Ontario for the nine months ended Sept. 30 show a production having a total value of $36,210,000, compared with $31,803,000 for the corresponding period of the previous year. Most of this increase was due to gold, this metal showing a value for the period of $18,171,000, which is an increase of $3,600,000. Of this amount $15,716,000 came from Porcupine and $2,131,000 from Kirkland Lake. Production from the various companies was as follows:

Hollinger	$9,419,000
Dome	3,203,000
McIntyre	2,624,000
Vipond	449,000
Teck-Hughes	801,000
Wright-Hargreaves	533,000

Production of silver of 7,331,000 oz. shows a decline of 1,300,000 oz. and is due in part to the burning of the mills of the Coniagas mine in Cobalt and the Miller Lake O'Brien mine in Gowganda. Of the ore shipped from the silver camps, 2,774 tons went to Ontario smelters and 2,206 tons was exported to the United States and Germany, the shipments to the latter country consisting wholly of residues. The larger productions were as follows in ounces:

Nipissing	2,458,000
Keeley	1,384,000
Mining Corp.	800,000
Coniagas	573,000
O'Brien	552,000
Menago	339,000
McKinley-Darragh	295,000
Castle-Trethewey	265,000

The value of the metallic nickel produced during the period was $4,164,000, an increase of $850,000, and the nickel in matte exported was valued at $2,719,000. The nickel oxide valued at $1,483,000 shows an increase of $260,000. Metallic copper valued at $1,577,000 showed little change. The copper exported in matte at $1,089,000 showed an increase of $216,000. Copper in the matte was valued at 9c. a lb., compared with 10c. in the previous year and nickel in the matte was valued at 15c., compared with 20c. in 1923. Metallic cobalt with a value of $346,000 shows a decrease of $170,000, but cobalt in unseparated oxides and residues valued at $396,000 records an increase of $214,000, while cobalt oxide is practically the same at $621,000.

In connection with the silver refineries it is interesting to note that the production of silver from these refineries was 3,681,000 oz. and the production of white arsenic from the same ore was 3,654,000 lb. or practically a pound of arsenic for every ounce of silver. Platinum metals were recovered having a total value of $286,000, an increase of almost $20,000 and these are divided into platinum, $129,000; palladium, $106,000; rhodium, $27,500; and irridium and ruthenium, $23,620.

Good reports continue to come from the Horne property in northwestern Quebec, and unofficial estimates give the ore reserves a total value of more than $20,000,000. To date only a comparatively small amount of underground work has been accomplished, but these estimates are based on a total of 14,000 ft. of diamond drilling. The company is spending $25,000 a month, but before going into any large-scale operations refinancing will be necessary. Preliminary plans call for a 1,000-ton smelting unit, but this will be dependent upon railroad transportation.

Tasmanian Government Would Co-operate to Develop Oil Shale

Oil Said To Be Available, but Capital Is Needed—Copper Output £500,000 Annually

The government of Tasmania, Australia, has called together in conference the people who own mining areas in the shale-bearing part of the country, to see whether they cannot co-operate to bring about the development of the formations.

The government declares it is prepared to do whatever it can to assist, and the Premier of the state has expressed the opinion that if public money has to be spent in placing this vast industry in embryo on a firm footing the people would be repaid a hundred-fold. The government geologist of Tasmania says the difficulty about the shale was not that of obtaining oil from it but of securing the co-operation of varied interests. A good deal of enthusiasm has now been shown in the matter, and as a result of the conference a committee is to meet in Hobart to try to arrange for the pooling of the various interests concerned. If efforts are successful, systematic exploration and development will follow.

A statement regarding mining activities in Tasmania for the year ended June 30 last shows that there was an increase of more than a quarter of a million pounds in the value of the mineral production of the state compared with that of the preceding year. The principal product is copper, the yield of which for the year was worth nearly £500,000, tin ranking next, followed in the order named by lead, limestones, silver, coal, and carbide.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

CONDITIONS all point to an unusually Merry Christmas in the metal mining camps; nor are effete city shareholders in mining companies without reason to feel cheerful as to their investments. In Mexico, the United States, and Canada, not to go too far from home, there are only isolated spots from which anything but good reports emanate. Expansion of plants and development of new orebodies are numerous and generally high production rates prevail. Even the iron-mining districts of the Lake Superior region, that had a bad season in 1924, are looking forward to a much busier winter than that of 1923-24 and to a large increase in ore shipments next year. Election day seemed to mark the turn of the tide in the iron-ore situation and operations have expanded measurably, both in stripping work in the open-cut districts and in production for stockpiles in the underground mines. Pickards, Mather & Co., for instance, announce that their underground operations in both Michigan and Minnesota will go on a 100 per cent capacity basis. In the Virginia district in Minnesota the Oliver Iron Mining Co. has increased its force to 850 men on winter stripping. Preliminary estimates place the shipments for next season at 65,000,000 tons. Even though this should not be quite realized the ore movement will far outstrip the 43,000,000 tons shipped during the season just passed. The iron men are good guessers and their forecasts are usually fulfilled.

The fundamental reason for prosperity among the nonferrous metal producers is, of course, the bouyant markets. Copper at 14c. and zinc at 7.05c. are better than they have been at any time this year; and lead at 8.85c. and silver at 69¼c., though slightly under the peak, are very satisfactory to producers. This is the cause; the effects may be revealed by a brief catalog of some of the recent developments in the various mining districts.

California—The Empire Mines has started the development of the recently acquired Sultana gold group at Grass Valley. The California Rand Silver announces that it will soon sink its main shaft an additional 500 ft.; the main shaft of the Argonaut will be deepened to 5,240 ft. on the incline; and the Engels Copper plans to increase its production by 20 per cent. Adrian D. Joyce, has remodeled and restarted the Bully Hill zinc smelter in the hope of reviving the abandoned enterprise of the Shasta Zinc & Copper Co.

Washington-Oregon—The completion of a long connecting raise by the Cornucopia Mines and plans for a new concentrator at the Bay Horse mine indicate activity in the Baker City district in Oregon. The Old Dominion and Gladstone, leading shippers of lead-silver ore in Washington, maintain production, and the Republic district is shipping 7,500 tons of $18 gold ore monthly.

Idaho—In the Coeur d'Alene district, 24,500 tons of lead and 2,200 tons of zinc concentrate ore is going to the smelters monthly. The Hercules, after producing $75,000,000, has made its last shipment; but the opening of fine new oreshoots in the Star and Hecla properties spells long and profitable production. The Bunker Hill smelter shipped 5,000 tons of pig lead in November. The Ford Motor Co. has taken over an option on the Red Bird lead-silver mine in Custer County, and the General Motors Co. is developing the Livingston group in the same region.

Nevada—The Comstock Merger mines has purchased the United Comstock mine and mill and will use the huge plant to cyanide its ores. The first work will be to extend the long haulage adit to serve the Merger properties. The Tonopah Extension has purchased twenty-one well-located patented claims northwest of its present property and will explore the ground. The Prince Consolidated, at Pioche, has taken over the Virginia Louise property and will unwater and develop at depth.

Utah—Two plants for the treatment of zinc-lead ores have recently been started: the combined Metal Reduction hydrometallurgical plant, and the remodeled mill at the International smelter. Formerly the Utah Consolidated copper concentrator, it has been remodeled to handle Park City zinc-lead ore by preferential flotation. All the camps in the state report new finds of ore and are increasing shipments to the smelters.

Arizona—The Miami Copper Co. is preparing to spend $800,000 improving its concentrator, and Inspiration has the excavations for its new $6,000,000 leaching plant one-fourth finished. Ore has been hoisted for the first time through Inspiration's new porphyry shaft. It is officially announced that the Humboldt smelter will be restarted in January if the present price of copper holds.

Montana—Regular operation of the Timber Butte mill and flotation plant has been resumed following a shutdown caused by a fire in the Elm Orlu mine. A new concentrator for manganese ore is being built by the Trout Mining Co. at Philipsburg, where two other companies are shipping regularly. Anaconda will spend $350,000 on improvements at the electrolytic zinc plant at Great Falls.

Colorado—Cripple Creek gold output is climbing, a number of small shippers adding to the total. October production was $585,576 and the total for the first ten months of the year exceeded the entire production of 1923 by $1,000,000. A new flotation concentrator has just been put in operation by the Ophir Colorado company, at Ophir, in San Miguel County. Operations at the Rico-Argentine at Rico have been resumed after six years' inactivity. Arrangements are being made to reopen the old silver mines at Cardinal, in Boulder County, where the 100-ton flotation plant will be remodeled.

Missouri—A market for zinc concentrate of $47 per ton has stimulated production in the Joplin-Miami field. A total of 153 mines in operation comes within one of being the highest on record. Many of these are on part time, however, and the weekly output is probably under 15,000 tons. The Federal M. & S. has shipped 55,739 tons of concentrate to date this year, placing it at the head of the list of producers. The Illinois Zinc Co., through its subsidiary, the Peru Mining Co., has undertaken mine operation for the first time. Skelton Lead & Zinc has finished rebuilding its No. 5 mill and the Quapaw Mining and American Zinc companies each have taken new leases.

Michigan—Copper production totaled 10,600,000 lb. in November. Two of Calumet & Hecla's Red Jacket slope shafts on the conglomerate lode are again in operation, and output can be increased if desired. Reports state that Seneca soon will resume production. Quincy is preparing to deepen its No. 2 shaft, which now bottoms at the 85th level.

Ontario—The International and Mond Nickel companies are increasing output in the Sudbury district to keep step with an expanding market. The Lake Shore at Kirkland has opened $100 gold ore on the 800 level, and, at Porcupine, the McIntyre is still following, on the 2,500 level, a shoot that has already been proved for 1,600 ft.—the longest in the history of the mine.

British Columbia—Receipts at the Trail smelter to Nov. 1 totaled 388,733 tons against 338,822 for the same period last year. The increase in metal content is even greater as the proportion of high-grade concentrate has increased. The zinc department of the Trail plant cannot handle all the concentrate, and the surplus is being sent to the Great Falls plant of the Anaconda company.

The Kafue Copper Development Co., at Antler Creek, has finished the construction of the first gold dredge in that region and will attempt operation during the winter. Granby Consolidated, at Anyox, has expanded copper production and is concentrating at the full capacity of its new mill. Unconfirmed reports tell of the opening of rich ore on the lower tunnel level of the Premier mine.

Mexico—Mexican conditions appear to be better than for a long time. A report just issued by the government shows that the production for the first seven months of the year was: gold, 16,000 kg.; silver, 1,800,000 kg.; lead, 105,000,000 kg.; copper, 31,000,000 kg.; and zinc, 9,900,000 kg. Since Aug. 1, a steady increase in production rates is reported. The American Smelting & Refining Co. is just starting its new by-product coke-plant and zinc retort-smelter at Rosita, Coahuila, and is constructing two flotation plants each of 400-ton capacity, one at Parral and the other at Charcas. Still another A. S. & R. project is the building of a new copper smelter at San Luis Potosi.

Northwest Mining Convention Held in Spokane

Representative Mineral Exhibit, Record Attendance, and Spirited Debate on "Blue Sky" Laws Feature Meeting

By Charles H. Goodsell
Special Correspondent

THE TWENTY-NINTH SESSION of the Northwest Mining Association opened in Spokane Dec. 1 with the largest delegation in its history of prospectors and small mine owners from British Columbia, Idaho, Montana, Oregon, and Washington. The first day was given over to addresses of welcome by local officials, all of whom predicted that the mining business was about to emerge from the lethargy of post-war depression and again take the position it held prior to the world war.

Exhibits of ore from many camps ranging from pocket specimens to displays of 1,000 lb. or more were arranged to attract the delegates. The display was on long tables occupying about 4,000 sq. ft. of floor space. Many handsome specimens of galena and copper minerals with rich specimens of native gold and silver in glass cases were included. One exhibit of the country rocks of the Coeur d'Alenes showing the whole range of the Belt series, together with the igneous rocks of the district, drew much attention.

The sessions on Tuesday, which was designated as Washington Day, opened with an excellent paper by Milnor Roberts, Dean of the School of Mines of the University of Washington, on "Legitimate Mining Promotion," in which it was advocated that independent mining reports by competent mining engineers should accompany all prospectuses of properties whose securities are offered to the public. Inasmuch as this paper virtually advocated "Blue Sky" legislation it precipitated the usual warm debate; and became an issue before the convention.

F. A. Ross, chairman of the day, and Grant Hinkle, Secretary of State of Washington, engaged in a spirited debate in which it was brought out that the Secretary of State under the present "Blue Sky law" of Washington is the sole person authorized to pass on promotions, which point has been opposed by all previous conventions. Mining securities are now exempt from the Washington law and Mr. Hinkle is advocating that the coming legislature include mining. Mr. Ross cited the fact that sixty-one laws, more or less, are now on the statute books of Washington, covering the whole field of fraudulent promotion and misrepresentation, and vigorously objected to authority being vested in one man or in a commission, arguing that no mining man would object to reasonable regulation by law, but always would oppose regulation by man.

On Wednesday, British Columbia Day, the program opened with A. G. Langley, Resident Engineer of the Columbia Mineral District, as chairman. Mr. Langley addressed the convention, giving a brief outline of mining in British Columbia. He sketched briefly the general geological conditions of the coast and Kootenai district, the two main sources of active mining which have produced in the gross $811,000,000 in gold, silver, lead, zinc, and building material. The main part of this able address was devoted to the vast possibilities of a great area of the province which invited exploration, especially by the prospector, whose numbers due to lack of encouragement were diminishing greatly.

The evening session was devoted to stereopticon views of the Coeur d'Alene mines and surface plants by Walter Clark, electrical engineer of the Bunker Hill & Sullivan Mining & Concentrating Co.

On Thursday, Idaho Day, Dean Francis A. Thomson of the University of Idaho School of Mines and Secretary of the Idaho Bureau of Mines and Geology, addressed the convention on the mineral resources of the state. He estimated the production of ores and metals to date at nearly a billion dollars. A. W. Fahrenwald, of the U. S. Bureau of Mines, spoke on concentration and classification and gave a demonstration with his flotation machine during the address. This was very instructive.

On Friday, Lloyd L. Root, State Mineralogist of California, delivered an address on the mineral resources of California. Conner Malott, a prominent banker of Spokane, spoke on "blue sky" legislation, in which he opposed the usual law, advocating a fraud law in lieu of it similar to the New York statute.

Resolutions were passed opposing "blue sky" legislation where a state official or commission was empowered to say whether or not a mining company could do business but advocating a requirement of publicity and laws designed to eliminate fraud.

Another resolution advocated the use of silver coinage in place of bills in smaller transactions, requesting the co-operation of the members in spreading favorable propaganda.

Early completion of the South Fork Highway in Idaho into the central Idaho gold fields and also into Ferry County, Wash., was advocated in another resolution. Co-operation with the Silver Producers' Association was urged.

A resolution commending the United States Senate Commission of Gold and Silver Inquiry for its effort to compel full compliance with the Pittman Act was adopted. Another recommended the repeal of the capital stock tax and asked an appropriation by Congress to complete the Geological Survey folios and reports so they might be available to mine operators.

The appointment of a committee by Congress to change the mining law to facilitate patenting land with no mineral outcrop yet admittedly valuable for mineral was advocated in still another resolution.

More than 500 delegates attended. The convention was really a prospectors' and small mine owners' gathering, although some prominent mine operators and educators were present. The enthusiasm of the delegates was marked. Frank C. Bailey, secretary of the Northwest Mining Association, was responsible for the success achieved. An old time dance, an oyster supper, and a smoker with illustrated lectures in the evenings constituted the social features of the occasion. It was declared the best convention and mineral exhibit ever held by the Northwest Association.

Winnipeg Board of Trade Forms Mining Bureau

The Board of Trade of Winnipeg, Man., has announced the formation of a mining bureau as a branch of its activities. The new bureau was organized on Nov. 6 and has opened quarters in the Board of Trade Building. Major T. C. Anderson is chairman.

An indication of the interest in mining in the Province of Manitoba is shown in the November report of the Dominion Government Mining Recorder at Winnipeg, which shows that sixty-two mining claims were filed in November, against nineteen for November, 1923.

Among those on the executive committee are Major T. C. Anderson, the chairman; W. LeB. Ross, local treasurer of the Canadian National Railways and president of the Manitoba branch of the Canadian Institute of Mining and Metallurgy, vice-chairman; and Prof. R. C. Wallace, former Commissioner of Northern Manitoba and now on the staff of the University of Manitoba.

Slate Producers Will Meet in New York

The topic of "Slate and Its Uses" will be considered in all its phases at the annual Slate Industry Conferences, to be held under the auspices of the National Slate Association at the Hotel Commodore, New York, on Jan. 19 and 20, 1925. These conferences are not restricted to members of the National Slate Association, but include all engaged in the production, sale, or installation of slate. In addition there will be special group meetings of each branch of the industry, the annual slate industry dinner, and a complimentary luncheon tendered to the slate trade by manufacturers and distributors of equipment and supplies.

Engineers Discuss Fuel Saving

The Ogden chapter of the Utah Section of the American Association of Engineers held its first meeting for the winter season at the Reed Hotel, in Ogden, on the evening of Dec. 4. The topic of discussion was smoke abatement and the reduction of fuel consumption, as announced by C. W. Cross, president of the Ogden chapter. This subject will be taken up throughout the entire organization, under the direction of the national president, Harold Almert, who during the war was director of the United States administration for fuel conservation, and who is an authority on the subject.

Men You Should Know About

Roy J. King, mining engineer of Grass Valley, Calif., recently made a business trip to Reno, Nev.

M. F. Coolbaugh, metallurgical engineer, recently made a trip to San Francisco on professional business.

W. V. Clark, flotation shift foreman at the Smuggler-Union mill, at Telluride, Colo., resigned on Nov. 25.

George A. Easley, mining engineer with the firm of Easley & Inslee, New York, sailed from New York on Dec. 11, for La Paz, Bolivia.

E. F. Burchard, geologist and engineer of the U. S. Geological Survey, has returned from a field trip in the Tennessee iron ore region.

H. D. Budelman, mine superintendent for the West End Consolidated Mining Co., at Tonopah, Nev., has returned to Tonopah from San Francisco.

H. W. Turner, of San Francisco, is examining mining property on the west coast of Mexico. He will probably return before January next.

J. D. Umpleby, formerly a member of the U. S. Geological Survey, was in Washington recently conferring with Survey geologists in regard to the Bradford oil sands.

H. W. Hardinge, president of the Hardinge Company, arrived from Europe on Dec. 3. Mr. Hardinge had been abroad the greater part of the year on company business.

Lloyd C. White, of Burch, Hershey & White, consulting engineers, has returned to San Francisco from a professional engagement of several months in San Bernardino County, Calif.

Daniel E. Huffman, Jr., metallurgist, who recently resigned his position with the Pacific Coast Steel Co., is engaged in flotation test work for the Golden Age Junior Mining Co., at Pioneerville, Idaho.

G. F. Loughlin is examining the deeper levels in Cripple Creek mines with the purpose of bringing up to date certain phases of the geology of that region. The examination will require several weeks.

D. H. Fairchild, of Fairchild & Fairchild, consulting engineers, of Chicago, has returned to that city from northern Ontario, where he conferred with many operators in the Timmins and Kirkland Lake districts respecting various grinding problems.

Harry Seaman, formerly efficiency engineer for the Fresnillo unit of the Mexican Corporation, at Fresnillo, Zacatecas, Mexico, has been transferred to Virginia City, Nev., where he will occupy a similar position with the Comstock Merger Mines Co.

Gordon Campbell, of Ishpeming, Mich., president of the Calumet & Arizona Mining Co., and the Verde Central Copper Co., is in Jerome, Ariz., inspecting the progress made at the Verde Central. The other directors of the company are expected in Jerome soon.

Morton Webber consulting engineer for the Minas Pedrazzini, made a recent visit to the mines of the company at Las Chispas, Sonora, Mexico. He is now at Mexico City in the interest of the Corporacion Minera de Mexico, for which company he is also consulting engineer.

N. C. De Ronne, vice-president and engineer of the Northwest Company, will assume the position of mine manager of the Lightning Creek Gold Grounds & Drainage Co., Ltd., when the Northwest Company leases of the ground owned by the Lightning Creek company are confirmed by the British Columbia courts.

Hugh F. Marriott

Hugh F. Marriott is paying another visit to the asbestos deposit in Greece on behalf of the company for which he is consulting engineer.

C. E. Moore, general superintendent of the Pitt Iron Mining Co., has resigned, and has been succeeded by **Frank S. Bergstrom,** formerly chief engineer of the Meriden Iron Co. at Hibbing. The offices of the company, formerly at Virginia, have been transferred to Aurora.

F. J. Katz, the head of the Mineral Resources Division of the U. S. Geological Survey, is making a field trip which will include visits to Pennsylvania, New York, Ohio, Illinois and Wisconsin. During his absence, **J. P. Dunlop** will be in charge of the Mineral Resources Division.

James F. McCarthy, of Wallace, Idaho, was in Washington last week conferring with acting Director Lyon, of the Bureau of Mines, in connection with the co-operative work being conducted in the Coeur d'Alene district on ore-dressing problems. This work has been in progress for several years and gradually is being widened in scope.

Frederick G. Clapp has been engaged for several months in geological explorations in the unknown regions of the so-called Kimberley desert, in the northwestern part of the Great Plateau of Western Australia. Much of interest has been found in a geographical sense and a vast area has been entered by motor tractor that has never been penetrated before by white men.

Stanley R. Moore, mining engineer of Wallace, Idaho, is home on a vacation after spending eighteen months in Alaska. He went there as the representative of a group of Wallace and Spokane mining men to investigate and develop a gold property situated eight miles from the Government Railroad and 100 miles south of Fairbanks. He will return to Alaska next month.

Dr. F. H. Newell, formerly head of the Reclamation Service of the U. S. Government and for a number of years connected with the civil engineering department of the University of Illinois, who is a specialist in hydraulic engineering and reclamation; **A. B. McDaniel,** whose experience is in general civil engineering work and, more recently, in personnel administration for the government and for industrial concerns, and **W. M. Corse,** who has specialized in non-ferrous alloys of brass, bronze, and nickel, with special reference to foundry practice and business administration, have joined the Research Service, of Washington, D. C.

Obituary

The **Rev. R. P. Cross,** of Twinsburg, Ohio, who was eighty years old, the oldest alumnus of the Oberlin Academy, and the discoverer of the "Cave of the Winds," died at Twinsburg on Nov. 19. He was an authority on mineralogy and the author of several books on the subject.

Frederick A. Fitzgerald, a prominent business man of London, Ont., died on Dec. 5 at the age of eighty-five years. He was the founder of the Imperial Oil Co. of Canada, and its first president, and at the time of his death was vice-president of the Standard Oil Co. in Canada. Mr. Fitzgerald was associated with various other industrial and commercial enterprises, and was a member of the Masonic order and the Foresters.

Norman A. Grose, assistant underground foreman for the Miami Copper Co., was instantly killed last month by a fall of rock in a drift on the company's 570 level. The accident occurred about 2 p.m. as Grose was making his final round of inspection before going off shift. Mr. Grose was thirty-nine years old and a native of Cornwall, England. He had been in the district about fourteen years, having first come here when ground was being broken for the Miami concentrator.

Grant Heatly Tod died suddenly recently at Livermore, Calif. As the treasurer of the Coast Manufacturing & Supply Co., Mr. Tod had many friends and acquaintances in the mining industry. A native of England, he received his early training in mining at the Homestake Mining Co., being at one time superintendent of that property. On account of ill health, Mr. Tod was obliged to give up mining, and moved to California, where he became connected with the Coast Manufacturing Co., first as salesman and later as treasurer.

New Machinery and Inventions

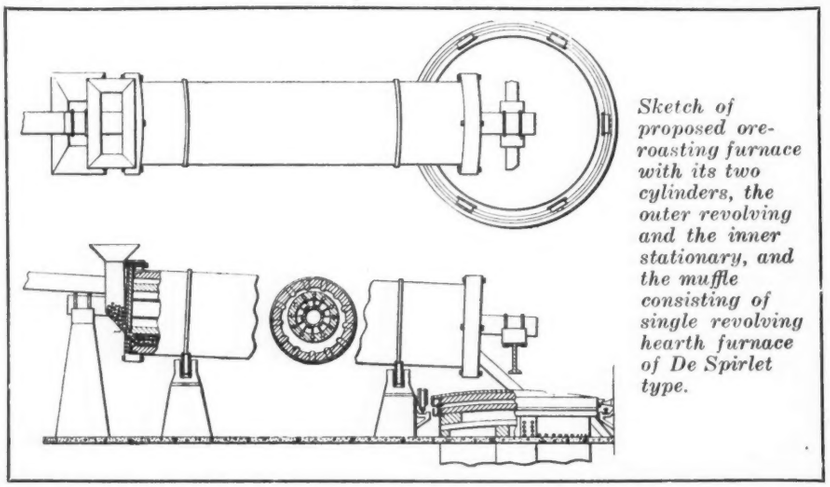
A Proposed Type of Ore-roasting Furnace

Intended for Dead Roasting Zinc Blende—It Would Embody Certain Mechanical and Operating Improvements

By D. Macmillan Kerr
Columbus, Ohio

A DESCRIPTION of a type of furnace which has not been tried commercially but which I have worked out after a number of years' work with other types of furnaces is given in the following paper. The proposed furnace is intended for dead roasting zinc blende, although with some modifications it could be used for other ores, particularly copper.

Of the different types of sulphide ores roasted, zinc sulphide offers the most difficulties because of the very complete elimination of sulphur necessary for success in the subsequent operations and because practically all zinc roasting is done with a view to using the gases for sulphuric acid manufacture, which demands a high sulphur dioxide concentration in the exit gases.



Sketch of proposed ore-roasting furnace with its two cylinders, the outer revolving and the inner stationary, and the muffle consisting of single revolving hearth furnace of De Spirlet type.

The three ways by which the roasting can be improved from a metallurgical standpoint are:

1. By lowering the sulphur content in the roasted ore.
2. By a reduction in the quantity of fuel used.
3. By raising the sulphur dioxide content of the roaster gases.

The improvements to be effected in operation are:

1. Reduction of operating costs over those obtained with the present types of apparatus.
2. Reduction of installation costs.

With these five ways of improving roasting in mind, the apparatus to be described was conceived.

First, for the benefit of those who read this article the roasting reactions and heat calculations are given to show how in what degree our present apparatus is not satisfactory in performing the duties it should perform with ease. The following calculations are based on those given in Richards "Metallurgical Calculations," Part 3, p. 596.

Roasting pure zinc sulphide,

$$2ZnS + 3O_2 = 2ZnO + 2SO_2$$
$$2(97) + 3(32) = 2(81) + 2(64)$$

As the ignition temperature of zinc sulphide is about 600 deg. C., a theoretical temperature of over 600 deg. C. obtained from the calculations for an assumed sulphur dioxide concentration will demonstrate that autogenous roasting is possible. It is pointed out here, however, that in practice the most desirable roasting temperatures range from 850 to 900 deg. C. Calculations are based on an assumed 3½ per cent sulphur dioxide concentration, and all calculations are based on molecular equivalents in metric units.

Amount of gases required to give 3½ per cent sulphur dioxide:

$\frac{22.22}{0.035}$ = 635 cubic meters per formula weight of SO_2 produced containing 635 — (22 + 127) = 486 cubic meters of excess air.

Heat input:

Heat in 97 kg. ZnS at 600 deg. C. = 8,032 kg. cal.
Heat evolved by 97 kg. ZnS = 111,060 kg. cal.
Total = 119,092 kg. cal.

Heat in products:

81 kg. ZnO = (10 + .0026t)t
22.2 cu.m. SO_2 = (8 + .0067t)t
127 cu.m. N_2 = (38 + .0034t)t
486 cu.m. air = (147 + .0131t)t

Total = (203 + .0258t)t

Heat input = heat in products, or 119,092 = (203 + .0258t)t.
Solving, t = 550 deg. C.

Therefore, it is seen that in any kind of roaster, to use the heat of reactions advantageously, a higher concentration of sulphur dioxide than 3½ per cent must be maintained. Similar calculations for a 6 per cent sulphur dioxide concentration give a temperature of 870 deg. C. It may also be of interest to note here that about 80 per cent of the total heat available in autogenous blende roasting will leave the furnace in the furnace gases.

The sulphur dioxide concentration necessary to roast autogenously an average blende analyzing, say, 57.7 per cent zinc, 29.55 per cent sulphur, and 2.4 per cent iron would be approximately a minimum of 6.5 per cent in an ideal furnace.

The application of mechanics to the roasting problem by different individuals has been varied in the extreme—more so than in any other branch of metallurgy. In every case it has been the aim of the inventor to make his furnace accomplish what seems to be an easy problem—namely, autogenous or nearly autogenous roasting, and, at the same time, to make his apparatus on a par of mechanical efficiency with other metallurgical operations (low costs, high tonnages, freedom from repairs, and so on).

The names of a few of the kilns which are now in use or have passed into history may be mentioned. There have been:

1. Numerous hand muffle furnaces.
2. Shaft roasters for lump ore of various designs.
3. The Gerstenhofer kiln—a step in the right direction but not capable of dead roasting and continuous operation.
4. Reverberatory furnaces.
5. The Hegeler kiln—most generally used in this country.
6. The De Spirlit roaster—use limited.
7. The Wedge roaster—now being tried out.
8. Dwight & Lloyd sintering machine. This apparatus has been used in some cases for roasting blende.

I have reduced to a few simple principles what I conceive to be the essentials necessary in any roasting operation. They are: (1) Proper contact between air and ore, and (2) proper temperature control and use of heat available.

To illustrate principle No. 1, the use of the Dwight-Lloyd sintering machine for roasting shows the result of proper contact between air and ore. What takes hours in a Hegeler furnace is done in a few minutes on this furnace. The reason the Dwight & Lloyd machine is not more generally used for blende roasting is because of the limitations which it puts on temperature control, or principle No. 2.

Description of Proposed Furnace

My proposed furnace consists of a revolving cylinder, with the axis inclined to the horizontal, well insulated on the outside of the steel shell as well as between the shell and the inside firebrick lining. The ore is fed in at the upper end and travels as in the ordinary cement kiln from one end to the other.

To obtain the necessary air and ore contact a second cylinder, which is stationary, is built inside the revolving cylinder and supported at each end outside the revolving cylinder. This cylinder fills the space in the big cylinder, leaving only the necessary room for proper contact between air and ore and the movement of the ore along the cylinder.

By the introduction of the inside cylinder, the ratio between air and ore is materially reduced. It is this high ratio which has been the bugbear in practically all of the types of fur-

naces tried or in use except the De Spirlet. As a glowing example of this principle of air and ore ratio, the time of roasting is cut from about forty-eight hours in the Hegeler to about six in the De Spirlet.

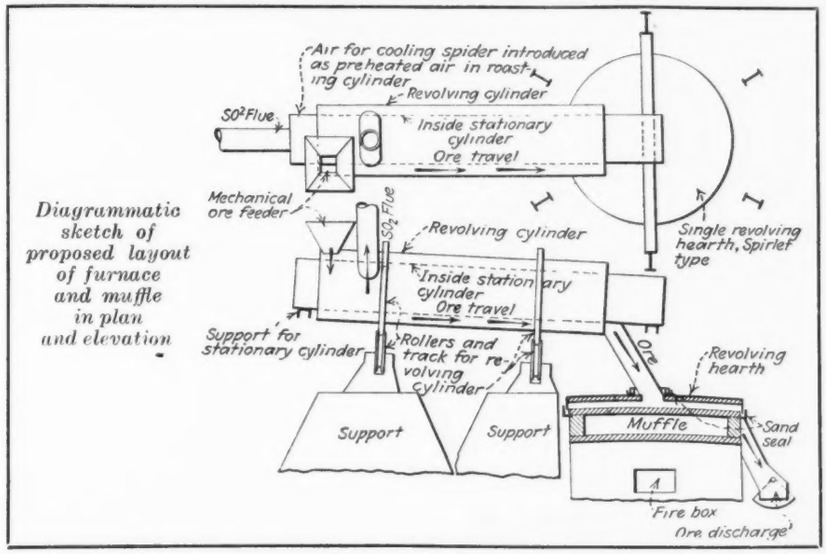
Experiments on the Hegeler furnace in which more frequent rabbling resulted in quicker roasting are another proof of my contention as to contact and air and ore ratio.

It is seen that ore will be carried up by the walls of the cylinder, with ribs if necessary, and will fall through the air, some of it striking the inside cylinder which will be at a high temperature, and thus by solid to solid contact as a flue for combustion gases, and in this way put heat in the cylinder, but I do not think that this is necessary.

I would use iron rabbles in the revolving hearth rather than firebrick as in the De Spirlet. The temperature and sulphur content in this part of the furnace would not interfere with the use of this type of rabble. Since there would be one hearth only, they would be replaceable without a shutdown.

I purpose building the furnace 16 to 24 ft. long, which makes it possible to introduce a cleaning bar from each end of the cylinder so as to reach every part of the inside of the cylinder.

The shaft principle has always been looked on as desirable for carrying on roasting or other metallurgical operations. The shaft was originally used for roasting lump zinc sulphide and later has been tried with agglomerated ore.



Diagrammatic sketch of proposed layout of furnace and muffle in plan and elevation

the ore will be heated much more quickly than by the air only.

There is only firebrick in the interior of the furnace, so that the cooling and mechanical troubles of the wedge and other types are avoided. Simple operation is certainly obtained.

The inside stationary cylinder takes a counter current of air, keeping the metal spider cool on which the brick cylinder is supported, and preheats the air which is to enter the furnace. To utilize more of the available heat, the preheating system can be extended so as to obtain heat from the exit gases.

I believe that with this arrangement a nearly autogenous roast is possible, but there are many possibilities for misjudgment, losses, unforeseen stops, variation in feed, and the like, so that I do not propose an entirely autogenous roaster for blende, although I would be highly elated if it were possible to devise one.

I propose to make the muffle a separate unit consisting of a single revolving hearth furnace, of the De Spirlet type, with firebox and muffle underneath. This hearth will take the discharge of the cylinder and finish it by the application of heat either as a reverberatory or a muffle.

It is only when the heat generated from reaction becomes low—that is, at the end of the roast—that it is necessary to use external heat. I therefore am convinced that the muffle construction gives all necessary heat control.

As an alternative it would be possible, instead of preheating the air for roasting, to use the stationary cylinder

Comparing my apparatus with a furnace of the shaft type, I can say that I put the shaft nearly horizontal instead of vertical and revolve the shaft itself. Thus the character of the ore may be changed from lump to fine, the simplicity of the shaft is to a great extent maintained, and the results, in my estimation, are improved over what we are accustomed to in any of the furnaces of existing type.

Another feature is that by having the two units in the same furnace (cylinder and hearth), I can change the rate of travel in the two sections independently, which is not possible in any other type of furnace.

Furnace Details

Proposed size	
Length of cylinder	24 ft.
Inside diameter of revolving cylinder	4 ft. 6 in.
Clearance between inside of revolving cylinder and outside of stationary cylinder at bottom	9 in.
At top	4 in.
Diameter of inside stationary cylinder	3 ft. 5 in.

The apparatus is to be designed so that the position of the stationary cylinder with relation to the revolving cylinder can be varied without much trouble. The inside of the revolving cylinder is to be provided with 2-in. ribs with 1-ft. centers to lift the ore up the sides of the cylinder. The ore feeder would be of a mechanical type feeder such as the cam and push rod type. The end pieces closing the ends of the revolving cylinder would be stationary and would be supported by the stationary cylinder. The ore feed inlet and the SO_2 gas outlet would be placed in the end piece.

The type of joint between the stationary ends and the revolving cylinder would be gas-tight or as nearly gas-tight as possible. The type of joint that I would use would be a sliding fit with spring pressure applied to take up the variation in the diameter of the revolving cylinder.

The size of the revolving horizontal hearth (De Spirlet type) for finishing the roast would be 12 ft. diameter. The height of the cylinder over the muffle hearth should be sufficient to make handling a cleaning bar on the bottom of the revolving cylinder easy, or about 3 ft.

I estimate that the proper speed of the rotating cylinder would be approximately one revolution in from two to five minutes. The cylinder drive would consist of the conventional gear and pinion with reduction gear and separate motor.

Estimated tonnage on the basis of a ten-hour roasting period would be eight tons per twenty-four hours, on the basis of a six-hour roasting period, fourteen tons per twenty-four hours. The amount of ore in the furnace would be two and one-half tons to four tons.

Costs

Little information is available in connection with zinc roasting costs where the SO_2 gas is used for sulphuric acid manufacture. The items generally included are: handling, direct labor, fuel, and indirect charges.

As roasting is a treatment process only, the material (zinc sulphide concentrate) is not valued or included in the operating costs. I understand that the figures vary from about $3.75 per ton roasting charge to about $4.50 per ton in plants in existence today. With direct labor and fuel cut to a minimum, and an average of about one and one-half men per shift for a battery of three units, I estimate the cost of my furnace would be from $2.50 to $3.50 per ton of ore. These figures may not check with records kept in different plants, because there is a different method of cost accounting for every plant, but I think that an analysis of costs as applied to this furnace will show that it effects a material advantage over the types now in use.

Trade Catalogs

Welding—A 12-page booklet bearing the designation Y-2019 describes the new Type A General Electric welding electrode. Details are given on electrode construction and characteristics. Results of tests on welded cast-iron specimens and deposited metal specimens are described, and oscillograms demonstrating arc stability are reproduced. Instructions for use of the electrode are supplied and specifications of the standard sizes given.

Drills—A new electric slate and marble drill is described by the Hisey-Wolf Machine Co., Cincinnati, Ohio, in Bulletin 3018-S.

The Market Report

Daily Prices of Metals

Dec.	Copper N. Y. net refinery	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
4	13.875@14.00	54.75	55.25	8.70	8.60	7.00
5	13.875@14.00	54.375	54.875	8.80	8.75	6.95@7.00
6	13.875@14.00	54.50	55.00	8.80	8.75	7.00
8	13.875@14.00	54.375	54.875	8.85	8.75	7.00@7.05
9	13.95	54.625	55.125	8.85	8.85	7.05@7.10
10	14.00	54.50	55.00	8.90	8.90	7.10
Av.	13 950	54.521	55.021	8.817	8.767	7.029

*These prices correspond to the following quotations for copper delivered: Dec. 4th to 8th, 14.125c@14.25c.; 9th, 14.20c.; and 10th, 14.25c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Dec.	Copper			Tin		Lead		Zinc	
	Standard		Electro-lytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
4	63¾	64⅞	68½	259½	262½	39¼	36⅞	35⅛	35¼
5	63⅞	64⅞	68¾	258½	261½	39⅛	37	35	35⅛
8	63¾	64¾	68¼	255⅝	258¾	39¼	37⅛	35 3/16	35 3/16
9	63 13/16	64⅞	68¼	256½	259⅝	39⅝	37⅝	35 9/16	35 9/16
10	64⅜	65⅜	68½	256½	259¾	40⅛	38¼	35⅝	35¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Dec.	Sterling Exchange "Checks"	Silver		Gold London	Dec.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
4	4.67⅝	68¾	32 15/16	89s 2d	8	4.69⅝	69⅜	33⅛	88s 8d
5	4.67⅝	69	32 15/16	89s 0d	9	4.70¼	69⅜	33 3/16	88s 5d
6	4 67⅞	69⅛	33 1/16	.. ...	10	4.69	69	33 1/16	88s 8d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Release of "Mining Journal-Press" Metal Quotations

SOME of our subscribers, who are particularly interested in our market quotations, do not understand how and when they are released, so the following explanation is made:

Daily metal prices for each week ending on Wednesday are established on the afternoon of that day, after a thorough survey of the market by two editors in co-operation with a representative of the U. S. Department of Commerce. These prices are available to those who may care to telephone for them, after 4 p.m. on Wednesday of each week, are wired to certain subscribers on Wednesday night, and are incorporated in special advance proofs of the pages comprising the Market Report which are sent by first-class mail also on Wednesday night. When a month ends on Saturday to Wednesday inclusive, the average *monthly* prices will be ready at 4 p.m., Wednesday, like the daily and weekly prices. But when a month ends on Thursday or Friday, a special market canvass is made, to prevent undue delay, so that monthly averages are available immediately after 4 p.m. on the last day of the month. Monthly averages for December will thus be ready on Dec. 31; for January, on Feb. 4; for February, on March 4; for March, on April 1; for April, on April 30; and so on.

A charge of $50 a year is made for the special wire or mail service, the messages being sent collect. For the monthly quotations alone, the price is $12. This advance service is for accommodation, not profit: the charges are to pay the extra costs. We do not solicit subscriptions to these special market telegrams and proofs, although we have long performed this special service, in the manner above indicated, to those who need it urgently.

Lead Prices Advance; Other Metals Firm

New York, Dec. 10, 1924—Increasing strength in lead was the feature of the week in the non-ferrous metal market, the leading producers advancing their prices after having held them steady for several weeks. Zinc and copper had a slight reaction, but have gone back to their high levels of last week.

Copper Producers Asking 14¼c.

Sales of copper have been markedly less than last week, but prices are substantially unaffected, as producers have recently been selling more than they are making and are content to rest on their oars for a week or so. December copper in fairly large tonnages was obtainable, at least until yesterday, for 14¼c. delivered. In some instances, sellers were willing to sweeten it with a little for January at that price. Today, some December was reported offered at 14.175c., but not accepted. For January and February delivery, copper was sold every day at 14¼c. delivered in the East, with 14⅜c. being secured on very small tonnages to Mid-Western points.

The foreign demand has been very satisfactory all week, 14.35@14.40c., c.i.f., ruling yesterday and today.

More Lead Sold at 9c.

The official contract price for lead, established by the American Smelting & Refining Co., was advanced from 8.65 to 8.75c. on Monday, Dec. 8, and to 8.90c. today, Dec. 10. The advance was not unexpected, as in the last two weeks increasing tonnages have found a market in the East at 9c. New York basis, and slightly above.

The continual advance in London has also made producers here more confident of the market and inspired a feeling that even higher prices here will not be followed by a serious reaction. Domestic production has, in recent

weeks, probably fallen somewhat behind domestic sales. In the Middle West, the efforts of one big producer to maintain a reasonable differential from New York prices are proving of less and less avail, the quantity offered being entirely insufficient to meet the demand. A substantial tonnage of lead was sold in St. Louis yesterday at 8.90c., and today at 9c. In Chicago, 9c. was paid for January lead as far back as last Friday.

The demand for lead is well distributed among all the usual trade outlets, orders for finished products being somewhat better than expected. Domestic production has so far been little increased by the higher prices. The necessity for the importation of foreign lead is not imminent, but should it come about, markedly higher prices would, of course, have to be paid.

Zinc Recovers From Slight Drop

Galvanizers and rolling mills have bought good tonnages of zinc during the week, and with a good export demand in the last few days the metal quickly passed again above 7c., after touching 6.95c. on Friday. An improved statistical position is expected when the November figures are announced. Near-by zinc is slightly easier to obtain than forward, though there is little price differential. High-grade continues at 8@8¼c. delivered.

Tin Firm Around 55c.

The tin market has held steady around 55c. all week, with consumers taking moderate tonnages of metal for early delivery. A little more interest is exhibited in forward tin, with prices for February and March ruling about ⅛c. per lb. above those for spot and near-by. The forward demand does not yet amount to much, however.

Tin imports into the United States, as classified by the New York Metal Exchange, follow:

	November, 1924	Eleven Months, 1924
Straits	4,575	48,850
English	550	6,005
Chinese	155	2,565
Banka and Billiton	105	1,792
Australian	45	515
Sundries	30	750
Total, long tons.	5,460	60,477

Arrivals to and including Dec. 9 amounted to 1,590 long tons.

Sterling at New High

Sterling exchange reached a new high during the week, but reacted today. On Tuesday, Dec. 9, closing cable quotations were as follows: francs, 5.405c.; lire, 4.3325c.; and marks, 23.82c. Canadian dollars declined to 3/32 per cent discount.

Silver Quiet and Dull

Silver continues quiet, with no features of special interest.

Mexican Dollars: Dec. 4th, 53c.; 5th, 53¼c.; 6th, 53⅜c.; 8th, 53½c.; 9th, 53½c.; 10th, 53¼c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, £125 per long ton.

Antimony—Per lb.:
Chinese brands, 14½c.
Cookson's "C" grade, 17⅞c.
Chinese needle, lump, nominal, 10c.
Standard powdered needle, 200 mesh, 11½c.
White oxide, Chinese, 99 per cent Sb_2O_3, 13@14c.

Bismuth—$1.50@$1.55 per lb. London, 6s.

Cadmium—60c. per lb. London, 2s. 2d.@2s. 6d.

Iridium—$325 per oz.

Nickel—29@30c. per lb. for 99 per cent virgin metal. Electrolytic, 33c.; London, £160 per long ton.

Palladium—$79@$83 per oz. Crude, $60@$65.

Platinum—$117 per oz. for refined. Crude, $111.

Quicksilver—$70 per 75-lb. flask. San Francisco wires $69.35; London, £11⅛.

The prices of **Cobalt, Germanium Oxide, Magnesium, Molybdenum, Monel Metal, Osmiridium, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Tungsten,** and **Zirconium** are unchanged from the prices given in the Dec. 6 issue.

Metallic Ores

Tungsten Ore—Per unit, N. Y.:
Chinese wolframite, $8.85@$9.
High-grade Western scheelite, $9@$9.25.

Chrome, Iron Ore, Galena and **Pyrite Radio Crystals, Manganese, Molybdenum, Tantalum,** and **Vanadium Ores** are unchanged from Dec. 6 quotations.

Zinc Ore Unchanged—Lead Ore Higher

Joplin, Mo., Dec. 6, 1924

Zinc Blende	Per Ton
High	$49.20
Premium, basis 60 per cent zinc	$48.00@$49.00
Prime western, 60 per cent zinc	$47.00
Fines and slimes	$46.00@$43.00
Average settling price, all	$45.08
Lead Ore	
High	$121.75
Basis 80 per cent lead	$122.50
Average settling price, all	$120.18

Rumors of $125 basis having been offered for future delivery of lead ore are current, but unverified. Buyers started the week with lower offerings for zinc ore, with sellers declining to accept, and a belated heavy demand late today strengthened the market and there was a near scramble for filling orders, closing at 6 o'clock. The purchase of 20,750 tons last week and 16,580 tons this week, with the production under 15,000 tons per week, is fast diminishing reserve zinc-ore stocks, which was decreased 16,200 tons for the year.

Platteville, Wis., Dec. 6, 1924

Zinc	Per Ton
Blende, basis 60 per cent zinc	$49.00
Lead	
Lead, basis 80 per cent lead	$122.50

Shipments for the week: Blende, 826 tons; lead, none. Shipments for the year: Blende, 29,872; lead, 1,426 tons. Shipments for the week to separating plants, 1,294 tons blende.

Non-Metallic Minerals

Bauxite — American, f.o.b. shipping point per gross ton:
Crushed and dried, $5.50@$8.75.
Pulverized and dried, $14.
Calcined, crushed, $19@$20.
Foreign per metric ton, c.i.f.:
French red, $5@$7.
Adriatic, low SiO_2, $5@$7.50.

Mica—Madagascar amber, dark, free from iron, per lb., f.o.b. New York:

No. 1	$2.75	No. 4	$0.75
No. 2	2.25	No. 5	.50
No. 3	1.35	No. 6	.30

Other mica prices in Dec. 6 issue.

Amblygonite, Asbestos, Barytes, Beryl, Borax, Celestite, Chalk, China Clay, Corundum, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Monazite, Ocher, Ozocerite, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and **Zircon** are unchanged from Dec. 6 prices.

Mineral Products

Arsenious Oxide (white arsenic)—6½@6¾c. per lb.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate, and **Zinc Oxide** are unchanged from Dec. 6 prices.

Ferro-Alloys

Ferromanganese—Domestic, German, and English, $105 per gross ton, f.o.b. works, or duty paid at seaport.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and Ferrovanadium are unchanged from the prices given in the Dec. 6 issue.

Metal Products

Rolled Copper—Sheets, 21⅝c. base; wire, 16⅜c.

Lead Sheets, Nickel Silver, Yellow Metal, and **Zinc Sheets** are unchanged from quotations published Dec. 6.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick, and **Zirkite are unchanged** from Dec. 6 prices.

Iron Trade Improving

Pittsburgh, Dec. 9, 1924

Shapes and bars are now selling firm at 2.10c., and plates at 1.90c. Most sheet mills are still booking actual orders, for shipment at mill convenience, at the old price of 3.50c. for black and 4.60c. for galvanized sheets and automobile sheets, the new prices, to which the market is expected to work upward, being 3.60c. and 4.75c. respectively. By reason of contracts the old wire prices, based on $2.75 for nails, will rule on deliveries practically through January. Tin plate contract for the new year are being entered at a moderate pace.

Pig Iron—Market quieter. Basic, lacking in recent test, nominal at $20 to $20.50 asked. Bessemer steady at $21, foundry being at $20.50@$21.50 according to tonnage, and brand, prices being f.o.b. Valley furnaces.

Connellsville Coke — Spot furnace coke, being scarce, is up to $3.50, spot foundry remaining $4@$4.50. First-quarter contracts, $3.25@$4.

Freight Rates on Metals, Ores, and Concentrates

Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$11.40	$10.00
Garfield, Utah	Perth Amboy	12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy	14.50	12.50
Miami, Ariz.	Perth Amboy	14.50	12.50
Anaconda, Mont.	Perth Amboy	12.50	.....
Butte, Mont.	Perth Amboy	12.50	.....
Humboldt, Ariz.	Chrome, N. J.	14.50	12.50
Douglas, Ariz.	Perth Amboy	14.50	12.50
Globe, Ariz.	Perth Amboy	14.50	12.50
Clifton, Ariz.	Perth Amboy	14.50	12.50
Clarkdale, Ariz.	Chrome, N. J.	14.50	12.50
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	12.50	.....
McGill, Nev.	Baltimore, Md.	15.90	.....
Houghton, Mich.	New York	(a) 11.40	.....
Hancock, Mich.	New York	(a) 11.40	.....
Hubbell, Mich.	New York	(a) 11.40	.....
Dollar Bay, Mich.	New York	(a) 11.40	.....
Tacoma, Wash.	New York via Canal	Conference rate	$6.00
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	14.50	$12.50

(a) Applies Dec. 1 to Mar. 31.

Marine Freight Rates

New York to	
Hamburg	*$5.00 per gross ton copper and lead
Liverpool	*5.50 per gross ton copper and lead
Antwerp	*4.50 per gross ton copper and lead
Havre	*4.75 per gross ton lead
	*5.00 per gross ton copper
Gulf ports to	
Hamburg	*$5.00 per gross ton copper and lead
Liverpool	*5.50 per gross ton copper and lead
Antwerp	*5.00 per gross ton copper and lead
Havre	*5.00 per gross ton copper
Pacific coast ports to	
Hongkong	$6.00 per short ton
Kobe	6.00 per short ton

Lead Bullion (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York	To St. Louis
East St. Louis, Ill.	$7.00	.....
Pueblo, Colo.	*12.50	$9.00
Leadville, Colo.	12.50	*9.00
East Helena, Mont	12.50	9.50
El Paso, Tex.	10.00 Via Gulf	
	12.00 All Rail	7.00
Omaha, Neb.	9.60	3.65
Murray, Utah	12.50	*9.00
Midvale, Utah	12.50	*9.00
Tooele, Utah	12.50	*9.00
East Chicago, Ill.	6.40	(a) 1.60
Kellogg, Idaho	13.50	9.50
Carnegie, Pa.	3.80	(a) 5.00
Selby, Calif.	(b) 6.00	.....
Herculaneum, Mo.	(a) 8.80	(a) 1.80
Federal, Ill.	7.00	(a) 1.80
Collinsville, Ill.	7.00	(a) .75½
Granby, Mo.	(a) 10.50	(a) 3.50
Joplin, Mo.	(a) 10.50	(a) 3.50

(a) Pig lead only.
(b) Conference rate, via canal.

Slab Zinc

From	Rates per Net Ton to E.St. Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	1.60	6.40
La Salle, Ill.	1.60	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	9.40	12.50
Park City, Utah	9.00	12.50

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	1.09
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	1.09
	Baxter, Kan.	1.40
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
Sand Springs, Okla.	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
Dewar, Okla.	Cave Springs, Mo.	2.00
	Cent City Spur, Mo.	2.00
Kusa, Okla.	Chitwood, Mo.	2.00
Henryetta, Okla.	Galena, Kan.	1.50
	Iola, Kan.	2.40
	La Harpe, Kan.	2.40
La Harpe, Kan.	Mound City, Kan.	.50
	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
Bartlesville, Okla. (a)	Baxter, Kan.	1.80
	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	22	.22	.22	.22
Butte, Mont.	Black Eagle, Mont. (a)	....	....	....	....	....	....	....	1.01	....	....	....	....	....	....	1.01
Great Falls, Mont.	East Helena, Mont.	....	....	1.57	....	1.76	....	1.98	....	2.43	....	....	....	....	....	2.55
Butte, Mont.	East Helena, Mont.	....	....	1.17	....	1.46	....	1.69	....	2.03	....	....	....	....	....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	....	....	....	....	6.30	7.00	7.70	....	8.35	8.60	8.85
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Pioche, Nev.	Humboldt, Ariz.	....	4.50(c)	7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	....	5.90	....	6.30	....	....	....	7.70
Kokomo, Colo.	Durango, Colo.	....	6.00	....	....	6.50	7.20	....	....	....	....	....	....	....	....	....
Telluride, Colo.	Durango, Colo.	....	....	....	....	....	4.30	....	5.00	5.50	6.00	6.30	....	6.60	7.10	7.70
Silverton, Colo.	Durango, Colo.	....	....	1.40	1.40	....	....	2.20	....	....	2.30	2.55	....	2.80	....	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Tyrone, N. M.	El Paso, Tex.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Lordsburg, N. M.	Douglas, Ariz.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	....	.90	....	....	....	1.30	....	....	1.60	....	....	1.90
Tombstone, Ariz.	El Paso, Tex.	....	....	1.90	....	2.50	....	....	....	3.80	....	....	4.40	....	....	4.40
Silver City, N. M.	Douglas, Ariz.	....	....	2.48	....	3.15	....	....	....	3.83	....	....	....	....	....	5.29
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. / Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C(d).	.30	.30	.30	.30	.50	.70	....	.80	.80	....	....	....	....	....	....
Republic, Wash.	Tadanac, B. C.	....	2.02	2.50	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Siliceous ore tailing.
(d) Applicable on ore, only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

From	To	Value of Ores and Concentrates $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho (a)	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	....	....	....	....	1.02
Burke and Wallace, Idaho (d)	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	....	4.25	4.50	4.75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	....	....	....	....	....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	....	....	....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	....	....	4.37½	....	....	5.12½
Park City, Utah	Salt Lake Smelters	1.00(e)	1.10	1.25	....	1.50	....	1.75	....	2.00	....	....	2.25	....	2.50
Eureka, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	....	2.75	3.00	3.25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	....	7.40	....	....
Goldfield, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	....	9.30	10.00	10.70
Battle Mountain, Nev. (a)	Salt Lake Smelters	....	4.15	3.20	....	3.80	....	4.40	5.00	5.60	6.20	....	6.80	7.40	8.00
Palisade, Nev. (a)	Salt Lake Smelters	....	2.90	3.20	....	3.80	....	4.40	5.00	5.60	6.20	....	6.80	7.40	8.00
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	....	7.40	8.10	8.80
Goleonda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	....	7.40	8.10	8.80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	....	7.40	8.10	8.80
Tonopah, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	....	9.30	10.00	10.70
Rogerson, Idaho	Salt Lake Smelters	3.00	....	3.50	....	4.00	....	4.50	5.00	5.50	6.00	....	6.50	7.00	7.50
Georgetown, Colo.	Leadville, Colo	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	....	5.80	5.80	5.80
Shirley, Colo.	Leadville, Colo.	....	....	2.25	....	2.25	....	2.25	2.25	4.30	4.30	....	4.30	4.30	4.30

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
* Indicates a change of tariff since last report.
(d) Crude ore for concentration, 30c. per ton, effective July 7.
(e) For $9 value rate is 95c.; $8 value, 90c.; $7 value, 85c.; $6 value, 80c.

Metal Statistics

Summary of Copper Statistics, 1924*

In Tons of 2,000 Lb.

	April	May	June	July	August	September	October
Production—							
Mines, United States	66,073	65,608	63,933	64,787	66,756	63,673	(c)
Blister, North America	76,688	81,988	80,514	79,361	77,264	78,633	85,841
Supply to American Refiners—							
Production blister by refiners	6,944	10,275	11,808	10,564	5,513	9,532	12,632
Receipts blister by refiners	81,633	83,547	80,291	87,513	78,467	72,730	83,162
Total new crude copper	88,577	93,822	92,099	98,077	83,980	82,262	95,794
Refined from scrap	1,463	3,642	2,893	2,865	2,745	2,761	(c)
Other production (a)	16,796	15,238	14,858	14,435	15,194	14,978	16,819
Grand total	106,836	112,702	109,850	115,377	101,919	100,001	115,413
Stocks (End of month)—North and South America:							
Blister (including "in process")	.....	.....	241,931	.....	.....	232,972	.....
Refined	.....	.....	112,195	.....	.....	136,756	.....
Total	.....	.....	354,126	.....	.....	369,728	.....
United Kingdom (d)	37,744	38,863	40,897	41,774	42,128	41,873	42,647
U. S. Exports (b)	49,350	49,154	46,358	39,020	40,887	48,624	(c)
U. S. Imports:							
Ore, matte, etc.	5,789	8,441	6,898	5,019	6,177	5,879	(c)
Metallic copper	20,990	22,755	33,638	26,669	22,877	21,070	(c)

* American Bureau of Metal Statistics. (a) Includes Chile, New Cornelia and Lake. (b) Metallic copper in all forms as reported by U. S. Department of Commerce. (c) Not yet available. (d) Official warehouses only.

Stocks of Copper—Other Countries*

In Tons of 2,000 lb.

	—United Kingdom (a)— Refined	Other Forms	Total	Havre (a)	Japan (c)
Jan. 1, 1920	.....	.....	17,667	.....	30,015
Jan. 1, 1921	10,637	2,407	13,044	6,684	30,798
Jan. 1, 1922	6,389	12,265	18,654	4,635	9,228
Jan. 1, 1923	10,191	19,803	29,994	3,746	13,564
Jan. 1, 1924	3,303	31,451	34,754	2,091	4,767
Feb. 1	2,640	31,196	33,836	6,596	4,782
March 1	2,713	30,841	33,554	4,684	5,824
April 1	2,790	31,764	34,554	5,915	5,936
May 1	4,752	32,992	37,744	7,146	7,504
June 1	4,927	33,936	38,863	10,662	8,848
July 1	5,207	35,690	40,897	11,452	9,632
Aug. 1	5,150	36,624	41,774	10,277	9,968
Sept. 1	5,869	36,259	42,128	10,154	(b)
Oct. 1	4,150	37,723	41,873	8,831	(b)
Nov. 1	(b)	(b)	42,647	(b)	(b)

(a) As reported by London Metal Exchange; official warehouses only. (b) Not yet available. (c) Bonded stock excluded.

Summary of Statistics of Copper Supplies*

In Tons of 2,000 lb.

	Production Smelters by Mines U. S.	Production by Smelters U. S. Smelters (a)	Refiners' Receipts of Blister Other Than From U. S. Primary Smelters From U. S. Secondary Smelters	From Foreign Smelters	Receipts of Scrap by Electrolytic Refiners	Total
1921	236,013	287,250	(b)	97,938	33,722	418,910
1922	493,854	565,570	(b)	154,332	50,592	770,494
1923	738,763	833,735	15,808	200,677	28,870	1,079,090
1924—						
January	66,631	75,734	951	21,857	2,159	100,701
February	65,681	73,791	1,064	16,576	1,813	93,244
March	65,181	74,338	789	17,162	2,899	95,188
April	66,073	71,072	706	21,823	3,717	97,318
May	65,608	75,734	845	20,203	3,837	100,619
June	63,933	74,948	607	18,376	3,225	97,156
July	64,787	74,072	358	23,165	2,678	100,273
August	66,756	73,074	299	16,502	2,602	92,477
September	63,673	74,390	454	12,922	3,087	90,853
October	.....	80,908	540	18,764	3,246	103,458
Totals	.....	748,061	6,613	187,350	29,263	971,287

(a) Primary smelters only. For statistical accounting the producers of Lake copper and direct cathode copper are reckoned as smelters. The blister copper produced at refineries is included. (b) Not reported.

Total Stocks of Copper, North and South America, 1923-1924*

In Tons of 2,000 Lb.

	Oct. 1, 1923	Jan. 1, 1924	Apr. 1, 1924	July 1, 1924	Oct. 1, 1924
North America:					
In blister at smelters	7,517	7,925	7,859	7,852	6,635a
In blister at refineries	54,522	41,279	36,472	30,381	22,572a
In transit to United States refiners from North American smelters	57,178	49,379	42,875	51,491	56,912
Total blister, North America	119,217	98,583	87,206	89,724	86,119
South America:					
In blister at smelters	5,857	9,911	9,906	6,119	3,280
In transit to United States	9,511	9,121	11,181	10,974	4,498
Total blister, South America	15,368	19,032	21,087	17,093	7,778
In process of refining, North and South America	133,783	135,765	129,736	135,114	139,075a
Refined, North and South America	126,549	155,885	119,462	112,195	136,756
Grand total	394,917	409,265	357,491	354,126	369,728
In ore and matte at United States refineries (not included above)	20,062	15,051	12,501	13,379	14,233

(a) Revised.
*American Bureau of Metal Statistics.

Copper Production by Smelters, Canada and Mexico, 1924*

Reported in terms of fine copper content in tons of 2,000 lb.

	June	July	August	September	October	Jan.-Oct.
Eastern smelters	10,295	10,674	8,718	11,072	13,697	108,281
Southwestern smelters	31,686	33,560	36,294	34,548	33,639	323,002
Northwestern smelters	32,937	29,838	28,062	28,770	33,572	316,778
Totals	74,948	74,072	73,074	74,390	80,908	748,061
Canadian smelters	2,609	2,447	1,697	1,297	1,893	21,613
Mexican smelters	2,957	2,842	2,493	2,946	3,040	31,488
Totals	80,514	79,361	77,264	78,633	85,841	801,162

* American Bureau of Metal Statistics.

Company Report

El Oro Mining & Ry. Co., Ltd.

Gold; El Oro, Mexico

The net profit earned by the El Oro Mining & Ry. Co. during the period ended June 30, 1924, amounted to £37,608 19s. 4d., which, added to the balance of £35,614 16s. 5d. brought forward from the previous accounts, makes a total credit to profit-and-loss account of £73,223 15s. 9d. On this amount £10,000 has been transferred to reserve against advances to the Compañia de Inversiones del Oro, S. A., which now stands at £40,000. The balance to credit of profit and loss is thus reduced to £63,223, 15s. 9d. Out of this sum the directors have declared a dividend of 6d. per share, or 2½ per cent, free of tax, which will absorb £28,687 10s., leaving a balance of £34,536 5s. 9d. to be carried forward.

During the year covered by the report 447,060 tons of ore was treated, yielding $1,879,458, being an average recovery of $4.20 per ton, compared with 399,820 tons and an average recovery of $4.88 per ton in the year ended June 30, 1923. This represents an all-round extraction of 83.82 per cent of the gross gold and silver contents of the ore, and compares with 86.29 per cent obtained in the previous fiscal year.

The total average working cost per ton of ore treated, including every expense incurred in Mexico, was $4.05, against $4.44 in the last fiscal year. Included in this cost is 34c. per ton for development, and 54c. for state and federal taxes.

The continued movement of the whole mountainside in the vicinity of the San Rafael vein, fully explained at the last annual general meeting, has increased the difficulties attending operations underground during the past fiscal year.

The report shows that the total tonnage of ore raised from the mine during the year ended June 30 exceeded by 115,000 tons the estimate of ore in reserve—namely 330,000 tons, at June 30, 1923. It is probable that if this ground movement does not become more pronounced, the ore production of the present fiscal year may approximate that of the past, and so on in varying degree beyond that period.

Mining Stocks

Week Ended December 6, 1924

Stock	Exch.	High	Low	Last	Last Div.
COPPER					
Alaska-Br. Col.	N. Y. Curb	...	...	*10	...
Anaconda	New York	43	40	42½	De.15, Ja.21, Q 0.75
Arcadian Consol.	Boston	1⅜	1	1¼	...
Ariz. Com'l.	Boston	11⅜	11	11⅛	Jy.19, Jy.31 0.50
Calaveras	N. Y. Curb	2½	2	2	...
Calumet & Arizona	Boston	*54	*52	*52	De.5, De.22 Q 0.50
Calumet & Hecla	Boston	17⅜	16½	17	My. 31, Jn. 16 0.50
Canario Copper	N. Y. Curb	4½	4⅜	4½	...
Cerro de Pasco	New York	52	48⅜	50⅞	Oc. 23, No. 1 1.00
Chile Copper	New York	35¼	34¼	34⅜	De.3, De.29, Q 0.62½
Chino	New York	28⅜	27	27	Sept., 1920 0.37½
Con. Coppermines	N. Y. Curb	3¼	3 1/16	3¼	...
Copper Range	Boston	28	26	26½	May, 1923 1.00
Crystal Copper	Boston Curb	*65	*60	*61	...
Davis-Daly	Boston	*45	*44	*45	Mar., 1920 0.25
East Butte	Boston	5	4⅜	4⅜	Dec., 1919 0.50
First National	Boston Curb	*37	*32	*32	Feb., 1919 0.15
Franklin	Boston	*80	*80	*70	...
Gadsden Copper	Boston Curb	*63	*60	*62	...
Granby Consol.	New York	19⅛	18	18⅛	May, 1919 1.25
Greene-Cananea	New York	17⅞	16⅞	17⅛	Nov., 1920 0.50
Hancock	Boston	*80	*80	*80	...
Howe Sound	N. Y. Curb	2⅛	2⅜	2⅛	Ap.1,Ap.15, Q 0.05
Inspiration Consl.	New York	31¼	28⅛	30⅛	De.20, Ja.7, Q 0.50
Iron Cap	Boston Curb	2	2	2	May, 1923 0.15
Isle Royale	Boston	*19	*18	*18¼	Se. 1, Se. 15 0.50
Jerome Verde Dev.	N. Y. Curb	1	*96	1	...
Kennecott	New York	51⅜	50	50⅛	De.2, Ja.2, Q 0.75
Keweenaw	Boston	*95	*90	*90	...
Lake Copper	Boston	2	1½	1½	...
Magma Copper	New York	38⅜	36½	38⅛	Jan., 1919 0.50
Mason Valley	N. Y. Curb	1⅛	1⅛	1½	...
Mass Consolidated	Boston	1¼	1	1	Nov., 1917 1.00
Miami Copper	New York	23⅜	22⅛	23¼	No.1 No.15 Q 0.50
Mohawk	Boston	37	35	36	Se. 22, Oc. 13 1.00
Mother Lode Coa.	New York	8⅜	8⅛	8½	De. 12, De. 31 0.37½
Nevada Consol.	New York	15⅜	14⅛	15	Sept., 1920 0.25
New Cornelia	Boston	23	21½	22⅜	No. 7, No. 24 0.25
New Dominion	N. Y. Curb	...	...	2½	...
North Butte	Boston	3	2½	2⅞	Oct., 1918 0.25
Ohio Copper	N. Y. Curb	1¼	1 1/16	1⅛	No.14, De.2 0.05
Old Dominion	Boston	24¼	23¼	24	Dec., 1918 1.00
Phelps Dodge	Open Mar.	†105	†101	...	Se.20, Oc.1 Q 1.00
Quincy	Boston	24½	23	24	Mar., 1920 1.00
Ray Consolidated	New York	17½	16¼	17	Dec., 1920 0.25
Ray Hercules	N. Y. Curb	*16	*15	*15	...
St. Mary's Min. Ld.	Boston	39⅜	37½	38½	Ap.22, My.20 3.00
Seneca Copper	New York	2¼	1⅜	1⅞	...
Shannon	Boston	1¼	*90	1⅛	Nov., 1917 0.25
Shattuck Arizona	New York	7	6⅞	7	Jan., 1920 0.25
Superior & Boston	Boston	1⅜	1⅛	1⅛	...
Tenn. C. & C.	New York	8⅞	8⅛	8⅜	De.31, Ja.15,Q 0.25
United Verde Ex.	N. Y. Curb	28⅛	28	28⅛	Oc. 3, No. 1 0.50
Utah Copper	New York	84⅜	81	84⅜	De.12, De.31,Q 1.00
Utah Metal & T.	Boston	*30	*20	*30	Dec., 1917 0.50
Victoria	Boston	...	...	1	...
Walker Mining	N. Y. Curb	3 1/16	3	3 1/16	...
Winona	Boston	*40	*30	*30	...
NICKEL-COPPER					
Internat. Nickel	New York	24⅜	23⅜	24	March, 1919 0.50
Internat. Nickel pfd.	New York	94¾	94¼	94⅛	Oc.16, No.1, Q 1.50
LEAD					
Carnegie Lead & Zinc	Pittsburgh	4⅛	4	4	...
National Lead	New York	163¾	158	159⅛	De.12, De.31, Q2.00
National Lead pfd.	New York	116⅛	116⅛	116⅛	No.21,De.15,Q 1.75
St. Joseph Lead	New York	40	38	38⅛	De. 9, De. 20 0.50
ZINC					
Am. Z. L. & S.	New York	11⅛	9⅛	10⅛	May, 1920 1.00
Am. Z. L. & S. pfd.	New York	35	31⅛	34	Nov., 1920 1.50
Butte C. & Z.	New York	9¼	8⅛	8⅜	De.10, De.24 0.50
Butte & Superior	New York	20⅛	18⅜	19	June, 1924 0.50
Callahan Zn-Ld.	New York	4¼	4	4	Dec., 1920 0.50
New Jersey Zn.	N. Y. Curb	181	178	178	Oc.,No.,'24 QX 4.00
United Zinc	N. Y. Curb	*40	*25	*40	...
Yellow Pine	Los Angeles	*68½	*61½	*61½	June, 1924 0.04
SILVER					
Alvarado	Boston Curb	...	...	1⅜	...
Beaver Consol.	Toronto	*22	*20½	*21⅜	May, 1920 0.03
Castle-Trethewey	Toronto	*72	*69⅜	*71	...
Coniagas	Toronto	2.25	2.25	2.25	Ap.20, My.1 0.02½
Crown Reserve	Toronto	*50	*48⅞	*49½	Jan., 1917 0.05
Keeley	Toronto	2.15	1.98	2.12	Sept. 15, SA 0.12
Kerr Lake	N. Y. Curb	2	2	2	Oc. 1, Oc. 15, 0.12½
La Rose	Toronto	*7	*6	*6½	Apr., 1922 0.10½
Lorrain Trout Lake	Toronto	1.40	1.35	1.35	...
McKinley-Dar.-Sav.	Toronto	*13	*10	*12	Oct., 1920 0.03
Mining Corp. Can.	Toronto	2.58	2.54	2.57	Sept., 1919 0.12½
Nipissing	N. Y. Curb	6½	6⅛	6¼	Oc.1,Oc.20,QX 0.30
Ontario Silver	New York	7	7	7	Jan., 1919 0.50
Temiskaming	Toronto	*19½	*19½	*19½	Jan., 1920 0.40
GOLD					
Alaska Gold	New York	*12⅛	*12⅛	*12⅛	...
Alaska Juneau	New York	1⅛	1	1	...
Argonaut	Toronto	*21¼	*21	*21	...
Carson Hill	Boston	*80	*80	*80	...
Consol. W. Dome L.	Toronto	*16	*15½	*15½	...
Cresson Consol. G.	N. Y. Curb	4	3 1/16	3¼	De.31, Ja.10 Q 0.50
Dome Mines	New York	13⅜	13	13⅛	De.31, Ja.20, Q 0.50
Golden Cycle	Colo. Springs	...	...	1.37	My.31, Jn.10 Q 0.03
Hollinger Consol.	Toronto	14.60	14.40	14.50	De.11, De.31, 0.05
Homestake Mining	New York	...	...	41⅜	De.11, De.26, MO. 50
Jib, Cons 1	N.Y. Curb	*52	*41	*50	...
Kirkland Lake	Toronto	*26	*25	*25¼	...
Lake Shore	Toronto	4.23	4.15	4.19	De.1,De.15,QX 0.10
McIntyre-Porcupine	New York	15⅛	15	15	No. 1, De. 1 0.25
Newray	Toronto	*24½	*23½	*23¾	...
Night Hawk Pen	Toronto	*4½	*4	*4	...
Portland	Colo. Springs	...	...	*50	Oct., 1920 0.01
Teck-Hughes	Toronto	1.13	1.12	1.12	...
Tom Reed	Los Angeles	*22	*20	*22	Dec., 1919 0.02
Tough-Oakes	Toronto	*37	*34½	*36½	...
United Eastern	N. Y. Curb	*37	*35	*37	Jy.18, Jy.31, Q 0.05
Vipond Cons.	Toronto	1.25	1.21	1.24	...
Wright-Hargreaves	Toronto	4.00	3.80	3.90	De.15, Ja.1,QX 0.15
GOLD AND SILVER					
Black Oak	N. Y. Curb	...	...	*89	...
Con. Cortez	N. Y. Curb	*11	*10	*10	...
Con. Virginia	San Francisco	7½	5½	7½	...
Continental Mines	N. Y. Curb	...	...	1¼	...
Dolores Esperanza	N. Y. Curb	...	...	*31	Jy.1, Jy.10 Q 0.05
Premier Gold	N. Y. Curb	2⅜	2½	2½	Se. 25, Oc. 30 0.08
Tonopah Belmont	N. Y. Curb	*55	*52	*53	Apr., 1923 0.05
Tonopah Divide	N. Y. Curb	*22	*18	*22	Se. 22, Oc. 10 0.10
Tonopah Extension	N. Y. Curb	3⅛	2 1/16	3	De.11, Ja.1 0.05
Tonopah Mining	N. Y. Curb	1 1/16	1⅞	1 1/16	Se.20, Oc.31 0.07½
Unity Gold	N. Y. Curb	*85	*72	*75	...
West End Consol.	N. Y. Curb	...	...	*50	Mar., 1923 0.05
Yukon Gold	N. Y. Curb	...	...	*50	June, 1918 0.02
SILVER-LEAD					
Ahumada	Boston Curb	6⅞	6½	6⅝	De.15, Ja.2, X 0.15
Bingham Mines	Boston	22	21	21	Sept., 1919 0.25
Cardiff M. & M.	Salt Lake	...	...	1	De.16, No.18 0.10
Chief Consol.	Boston Curb	3⅛	3⅛	3⅛	Ap.19, My.1,Q 0.10
Columbus Rexall	Salt Lake	*27	*26	*26	Aug., 1920 0.03
Consol. M. & S.	Montreal	49	46½	49	Jn.30, Jy.15 0.75
Daly Mining	Salt Lake	1.50	1.50	1.50	July, 1920 0.10
Erupcion	Boston Curb	2⅛	2⅛	2⅛	De.15, Ja.2, X 0.15
Federal M. & S.	New York	17⅞	16⅞	17⅛	Jan., 1909 1.50
Federal M. & S. pfd.	New York	59⅛	55	58⅛	No.25, De.15, 1.75
Florence Silver	Spokane	5⅛	5	5⅛	Apr., 1919, QX 0.01
Hecla Mining	N. Y. Curb	*10	*9⅞	*9⅞	No.15, Dn.15 0.25
Iron Blossom Con.	N. Y. Curb	*37	*35	*35	Oc.25, 1924 0.02½
Marsh Mines	N. Y. Curb	*4	*4	*4	June, 1921 0.02½
Park City	Salt Lake	4.75	4.70	4.75	Dec. 15, 1924 0.15
Park Utah	N. Y. Curb	...	...	3⅛	Mc. 15, Ap. 1 0.15
Prince Consol.	Salt Lake	*15⅛	*11⅛	*11⅛	...
Silver King Coa.	Salt Lake	...	...	5.10	Oct., 1924 0.15
Silversmith	Spokane	*28⅛	*27⅛	*28	Oc. 1, Oc. 10 0.01
Tamarack-Custer	Spokane	1.38	1.35	1.36	Se. 22, Se. 29 0.25
Tintic Standard	Salt Lake	9.00	8.75	8.95	Se.1, '24, X 0.25
Utah-Apex	Boston	3⅛	2⅜	3⅛	Se.5, Se.15, Q 0.25
IRON					
Bethlehem Steel	New York	49¾	47⅛	48⅝	Jn.1, Jy.1, Q 1.25
Char. Iron	Detroit	*25	*25	*25	...
Char. Iron pfd.	Detroit	*73	*72	*73	...
Colorado Fuel & Iron	New York	41⅛	39⅛	39⅛	Au.11, Au.25,Q 2.00
Col. Fuel & Iron pfd.	New York	...	...	108⅛	No.10, No.26 Q 2.00
Gt. North'n Iron Ore	New York	36⅛	34⅜	34⅜	De.10, De.27 2.00
Inland Steel	N. Y. Curb	...	...	4	No.14, De.1, Q 0.62½
Mesabi Iron	N. Y. Curb	...	...	2⅞	...
Replogle Steel	New York	23	19	19⅜	...
Republic I. & S.	New York	57⅜	53	55	May, 1921 1.50
Republic I. & S. pfd.	New York	93⅜	92	93	De.16, Ja.2, Q 1.75
Sloss-Sheffield S. & I.	New York	82	78	79½	Se.11, Se.20, Q 1.50
Sloss-Shef. S.&I. pfd.	New York	92	91	91	De.9, De.20, Q 1.75
U. S. Steel	New York	118⅛	116	117	No.29,De.3, QX 1.75
U. S. Steel pfd.	New York	121⅞	121⅛	121⅜	No.4, No.29, Q 1.75
Virginia I. C. & C.	New York	...	...	45	De.15, Ja.2 1.50
Virginia I.C.&C.pfd.	New York	78⅛	78⅜	78⅛	De. 13, Ja. 2, Q 2.50
VANADIUM					
Vanadium Corp.	New York	30⅜	28⅛	29	Jan., 1921 1.00
ARSENIC					
Western Utah Copper	N. Y. Curb	*19	*19	*19	...
ASBESTOS					
Asbestos Corp.	Montreal	31⅛	31	31	Se.29, Oc.15 Q 1.00
Asbestos Corp. pfd.	Montreal	66¼	66¼	66½	Oc.1, Oc.15, Q 1.50
SULPHUR					
Freeport Texas	New York	11⅛	9⅛	9⅜	Nov., 1919 1.00
Texas Gulf	New York	95⅛	89¾	90½	De.1,De.15, QX 2.25
PLATINUM					
So. Am. Gold & P.	N. Y. Curb	4⅛	3⅜	4	...
MINING, SMELTING AND REFINING					
Amer. Metal	New York	51⅛	49	49⅞	No.19, De.1 Q 0.75
Amer. Metal pfd.	New York	114⅛	113	114⅛	No.20, De.1, Q 1.75
Amer. Sm. & Ref.	New York	88⅜	86⅛	86⅛	Oc.17, No.1, Q 1.25
Amer.Sm.&Ref.pfd.	New York	105½	105	105	No.17, De.1 Q 1.75
U. S. Sm. R. & M.	New York	38	36⅛	36⅜	Jan., 1921 0.50
U.S. Sm. R.&M.pfd.	New York	46⅛	45¾	46⅛	Oc.9, Oc.15 Q 0.87

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.